The
Tropical Agriculturist
May, 1934

EDITORIAL

PLANT PESTS

WITH the opening of new land for cultivation in Ceylon more and more does one become acquainted with new problems that beset those attempting to grow crops thereon. Not by any means the least important of these problems is the presence of insect and other pests that have been living unregarded so long as the land was uncleared but which were in the jungle to pounce upon the cultivators' crop as an appreciated change of diet, or, a diet related to that to which they have been accustomed but been unable to obtain. No sooner was land brought under paddy at Minneriya than the paddy fly appeared in fields where no paddy had been grown before.

As our knowledge has been accumulated and the individual organisms preying upon various plants become better known we have to add to the list of animal and fungus pests those of the eelworm which is showing itself to be very common in our soil and attacking the roots of so many of our economic plants. Although it has not so far been demonstrated it is quite possible that certain virus diseases may in the future be found to be transmitted underground from plant to plant by this creature. Eelworm is a very common and serious pest in our tobacco fields. Its control is only to be effected by rotation and cultivation so as to provide it with no food upon which it can exist and so starve it out. A jungle cleared for tobacco shows the land, as soon as planted, to be infested with eelworms, a small nematode

worm laying its eggs in the tobacco roots causing pill-like swellings thereon and the wilting and ultimate destruction of the plant. Or, it may be the presence of a host of minute aphides on our tobacco and bananas carrying elusive virus diseases from one infected plant to another until the whole field is stricken by a yield-reducing infectious disease of, perhaps, an obscure origin, and difficult to control.

The very disturbance of primeval jungle may be the upsetting of what is often called the "balance of nature" or that biological control that previously existed. The great evolutionary equation of the tendency for offspring to increase beyond the bounds of subsistence involving a struggle for existence and resulting in the survival of the fittest is for the moment upset and the bounds of subsistence being enlarged there comes intense attack.

The liability of our garden vegetables to insect attack is well known, and, troublesome though it may be, effective control of them is usually practised in a comparatively cheap and effective way. Virus diseases of plants transmitted from one to another by insects or by leaf contact are in a more difficult category.

Some insects have a complicated life-history, part of their existence being spent on one species of plant and part on another. It is only when the natural history has been thoroughly unravelled, all the phases of their life known, and the most vulnerable stage discovered that they can in any way become subjected to control. Insect and fungus control is now in advanced agricultural countries fast becoming as important an operation as cultivation itself, indeed many of the stages of cultivation perhaps unknowingly have themselves been highly important factors in effecting amelioration. Bold large stage campaigns are now often embarked upon against plant pests in many countries and the wisdom of such is obvious in the case of a dangerous enemy. There has been some little attention directed lately to the need for this in combating *Oidium* disease of our rubber.

Largely due to its variable climate with a season for many crops existing somewhere all the year round Ceylon might almost be regarded as the homeland of plant pests and diseases.

PASTURE TRIALS AT PERADENIYA

SOME NOTES ON THE GRASSES UNDER TRIAL—*(Contd.)*

J. E. SENARATNE, F.L.S.,

SYSTEMATIC ASSISTANT, DIVISION OF ECONOMIC BOTANY

IN the account of the individual species of grasses under trial at Peradeniya two of the most important genera from a pasture point of view are Panicum and Paspalum.

PANICUM LINN.

The genus Panicum is the largest genus of the grasses and comprises about 500 species out of the total of about 5,750 species constituting the grass family. These Panicums are distributed all over the world. They are mostly found in the tropical and sub-tropical regions. A few occur in the warmer temperate regions. They are found in very diverse habitats, on moist sandy soils chiefly, on the seashore, along river banks, in open spaces in jungles, on marshy places and even in water while some are desert species. Some of them are perennial and others are annual. They are of varied habit and size. Most of them are tufted grasses but some are creeping. The majority of them are soft and readily eaten by cattle and other herbivorous animals. Some of them are cultivated for their grain. Thus *Panicum miliaceum* Linn. which is known as Meneri in Sinhalese and Kadai Kannai in Tamil is much cultivated in the hotter parts of Ceylon. It is also known as 'Proso Millet', 'Broom-corn Millet', 'Hog Millet' and 'Indian Buffalo Grass'. It is largely cultivated in India. It is cultivated also as a fodder in warm temperate countries and elsewhere. *Panicum miliare* Lamk. which is known as Hin-Meneri in Sinhalese, Chamai in Tamil and as 'Little Millet' is another species cultivated for its grain in Ceylon, India, and elsewhere. Some of them are cultivated for fodder or pasture. *Panicum maximum* Jacq. which is generally known as Guinea grass is an excellent grass both for fodder and pasture. It grows on all kinds of soil and gives a very high yield. It is a native of Tropical Africa and it has been introduced into most warm countries. It is one of the best tropical fodder grasses. In Ceylon it is widely cultivated as a fodder and it occurs in a

naturalised state from sea level up to an elevation of 4,000 feet. Of this grass Hooker [5] says "The well-known Guinea Grass was introduced from West Tropical Africa into Jamaica about 1774, by Mr. John Ellis, as food for some birds which he had imported. The birds died, and the seed, being thrown away as useless, yielded a magnificent grass greedily eaten by cattle and horses. It was introduced into India in 1802 by Sir John Sinclair and must have been rapidly disseminated, for I find a specimen in Rottler's Herbarium . . . . received from Heyne, with the date June 3, 1808. There is no record of its introduction into Ceylon, but it is included in Moon's Catalogue, published in 1824."

There are also several other cultivated Panicums. In addition to the three introduced species mentioned above, there are eleven (and probably another) species which are indigenous in Ceylon. Of these *Panicum repens* Linn. is a good sand binder in addition to being a useful fodder and pasture species. The following two species of Panicum are under trial at Peradeniya.

21. *Panicum repens* Linn. is an indigenous grass very common throughout Ceylon especially on dry sandy or wet marshy soils. It is known as Etora in Sinhalese and as Couch grass in English. It is widely distributed in Southern Europe, Asia, Africa and America. It is a perennial, spreading, creeping and tufted grass one to three feet high. It is generally considered a weed on cultivated land and once established it is very difficult to eradicate.

Grown from cuttings it spreads and establishes itself very rapidly, in six months producing a dense growth of erect secondary stems about a foot high from the creeping horizontal stems. It began to flower at Peradeniya in four months and has kept on seeding since. The Desmodium was entirely killed by the dense growth of the grass.

Cattle eat it readily and the yield is high. Generally it is considered to be very exhaustive on the soil but from a pasture viewpoint it is a very promising grass.

22. *Panicum trypheron* Schult. is an indigenous grass common at low and medium elevations in Ceylon. It is also found in India, China and Borneo. It is an annual or perennial tufted grass one to three feet high.

At first its growth from the cuttings planted was poor but gradually it improved and in six months' time, by January 1934, it had produced large tufts with a spread of about three feet

and up to two feet high when it started flowering. It continued to set seed from January to March. The Desmodium grew well between the tufts.

Its yield is good and it is readily eaten by cattle at all stages of growth. It is a promising pasture grass.

PASPALIDIUM STAPF

The genus *Paspalidium* was established by Stapf in 1917. It is closely allied to *Paspalum* Linn. and to *Panicum* Linn. *sensu stricto* and its species used to be regarded previously under *Panicum* Linn. *sensu lato*. It contains twelve species distributed in the tropics and sub-tropics of the Old World, six being confined to Australia and New Caledonia. Three species are indigenous in Ceylon. They are perennial or rarely annual grasses inhabiting diverse habitats ranging from dry sandy situations to moist and semi-aquatic places while some inhabit water. They are generally succulent grasses readily eaten by cattle. The 'Warrego Summer Grass' of Australia (*Paspalidium flavidum* A. Camus) has been found to be a distinctly promising grass for laying down cultivated pastures in New South Wales. This is one of our indigenous grasses which is very readily eaten by cattle. It has been cultivated in the present trials and is described below. *Paspalidium geminatum* Stapf, another indigenous grass found in wet places in the hotter parts of Ceylon, is also very palatable to stock. The other indigenous species *Paspalidium punctatum* A. Camus is a marshy species with floating stems. This species is also eaten by cattle. The following species is included in our trials.

23. *Paspalidium flavidum* A. Camus is an indigenous grass found abundantly in the warmer parts of the Island particularly in wet situations. It is known as Warrego Summer Grass. It is distributed also in Tropical Asia and Australia. It is a tufted perennial or annual grass with stems one to three feet high.

Seed was sown on 20th June, 1933. Growth was slow at the start but improved later and by January 1934 the plants were forming shortly spreading tufts some of which were up to two feet in spread and about a foot high. It set seed from January and continues to do so up to the present (April 1934). The Desmodium was good between the smaller tufts which did not entirely cover the ground.

It is very readily eaten by cattle. Its yield is good at Peradeniya but in the wild state in wet situations the yield is much higher.

It is a distinctly promising pasture grass especially for wet situations.

PASPALUM LINN.

The genus Paspalum comprises over 200 species distributed in the warmer regions of the world, chiefly in Tropical America. Most of them occur in wet situations while some grow in water. They are annuals or perennials and vary much in size and form. These grasses are readily eaten by cattle. Several are valuable fodder and pasture grasses.

'Water Couch Grass' (*Paspalum vaginatum* Sw.) is an excellent pasture grass for growing on coast swamps and on tidal mud. It is a perennial creeping grass found in the tropics generally. Of it Breakwell [6] says "Water Couch is known in America as Eternity grass, Knot grass, or Joint grass, and is there credited with being a particularly valuable fodder plant . . . . Under moist conditions the rapidity of its growth is remarkable . . . Although common to moist situations, it is not wholly a water grass, as it will endure drought conditions very well. Dairymen on the Hunter, Manning and Macleay Rivers are quite content to devote whole paddocks to it during the summer and autumn months rather than lay down *Paspalum dilatatum*. It will stand a good deal of feeding off, and must be considered an excellent grass for fattening and producing milk."

It is an indigenous grass and it has been recorded so far from Negombo, Talaiyadi and Talaimannar.

Paspalum scrobiculatum Linn. which is known as Amu in Sinhalese and Varagu in Tamil is cultivated in Ceylon and India for its grain. *Paspalum dilatatum* Poir. which is known as 'Paspalum grass', 'Prostrate Paspalum' or 'Dallis grass' is a very useful fodder grass. It is a native of South America and it is much cultivated in most warm countries. This grass was introduced into New South Wales from Brazil some forty years ago by Baron von Müller. Since then vast areas of the sub-tropical East coastal region of Australia has been put under this grass and is spoken of as "the Paspalum country". The New South Wales and Queensland Governments have removed the former forests, planted *Paspalum dilatatum*, and so made a huge dairying industry possible. The largest dairy factories in the world are now to be found here due solely to a bold policy in introducing this plant. Old seed, even two seasons old of this species germinates much better than new. [7]

Paspalum Larranagai Arech., known as 'Upright Paspalum' or 'Vasey grass' is also much cultivated for the same purpose. The two latter species are cultivated in Ceylon for fodder. *Puspalum conjugatum* Berg. which is known as 'Sour grass' is an important pasture species in the tropics chiefly in Tropical America.

In Ceylon in addition to the last four species of which the first three are cultivated and the fourth is naturalised, there are four species of Paspalum which are native. They are 'Water Couch Grass' already mentioned (*Paspalum vaginatum* Sw.), *Paspalum Metzii* Steud., *Paspalum Commersonii* Lamk. and *Paspalum longifolium* Roxb.

Of this genus we have three representatives in our trials.

24. *Paspalum conjugatum* Berg. is an American grass naturalised and now common throughout Ceylon. It is known as the Sour Grass of Barbados. It is a perennial, long-creeping grass, sending up erect shoots at the nodes, up to a foot or more high.

Seed was sown on 15th June 1934. It started well and the plants spread rapidly from their centre. In six months it has produced a thick mat with a dense growth of erect branches about a foot high choking out most of the Desmodium. It set seed from January to March.

Cattle eat it readily but not to such a degree as 'carpet grass' (*Axonopus compressus*). Its yield is high. It is a promising pasture grass.

25. *Paspalum dilatatum* Poir. a native of South America and introduced here where it is cultivated for fodder from the sea level up to 6,000 feet. It is known as 'Paspalum grass,' 'Prostrate Paspalum' or 'Dallis grass'. It is also widely cultivated in Australia and America. It is a perennial tufted grass one and a half to three feet high.

From the start its growth from the cuttings planted was very good and in five months it had produced dense tufts with a spread of one and a half feet above and two to three feet high when it started flowering. It set seed from December to March. Having been planted one foot by one foot apart, in five months it covered the whole area. The Desmodium was entirely killed out.

Cattle eat it very readily at all stages of growth and its yield is very high.

It is a very promising grass.

26. *Paspalum Metzii* Steud. is an indigenous grass common from the sea level up to 6,000 feet in the Island, occurring generally on wet situations. It is probably found also in India. It is a perennial grass with tufted or creeping stems.

Grown from cuttings, it started well and kept on growing to form tussocks with a spread of one and a half feet and a height of one foot in six months' time, when it began to flower. It set seed from January to March when the older stems began to die out. The Desmodium grew fairly well between the tufts of the grass.

Its yield was fair but it should do much better on a wetter place. Cattle eat it readily and it is a promising pasture grass.

27. *Pennisetum clandestinum* Hochst., a native of East Africa and now much cultivated in Africa and Australia, is a perennial long-creeping, fast-spreading grass. It is generally known as Kikuyu grass. It does not grow from seed. Rooted cuttings of this grass were obtained from Australia in November 1921 and planted at the Experiment Station, Peradeniya. Its import was not then understood for it was tried as a fodder grass.

Cuttings were again obtained from Australia in 1933 and planted two feet apart in rows on 19th November, 1933. This plot was manured with about 40 cwt. of cattle manure and 10 lb. of basic slag. The plants were watered till they were established and also during drought. In two months the plants were growing and spreading vigorously. In three and a half months the plants have spread very fast so as to form a thick mat of dense growth.

Cattle eat this very readily and the yield is very high. It is a most promising pasture grass.

28. *Polytrias amaura* O. Ktze. is a native of Java from where it was introduced here to the Experiment Station, Peradeniya, in 1931. It is a perennial creeping grass rooting abundantly at the nodes and growing to a height of one foot or more. It was introduced into our trial plots and from the time of planting cuttings the grass showed good growth, it kept on improving and in four and a half months it produced a thick growth covering the whole ground. The Desmodium grew fairly

well with it but was crowded out where the growth of grass was thick. It flowered in January when six months old and kept on setting seed from January to March. There was an abundance of seed.

This grass gives a good yield and at all stages of growth it is readily eaten by cattle. It is promising as a pasture grass.

29. *Rhynchelytrum roseum* Stapf and Hubbard, a native of Natal, now naturalised at low, medium and high elevations in Ceylon, is a perennial (or annual) tufted grass up to two feet high. It is known as 'Natal grass' or 'Natal Red Top grass', the latter name being derived from the colour of its inflorescence.

Seed was sown on June 15th, 1933. It grew fast and well and in five months it had produced fairly large tufts about two feet high and was flowering. From that time it has continued to set seed. The Desmodium was growing fairly well in between tufts of the grass.

Cattle eat it readily and its yield is good. It is a promising pasture grass. It appears to grow on poor soils. It flowers early and keeps on flowering but if regularly grazed before flowering it should prove most valuable.

30. *Setaria glauca* Beauv. is an indigenous grass which is common all over the Island. It is known in Sinhalese as Kavalu. It is widely distributed in warm and temperate regions. It is a tufted annual with erect or decumbent stems one to two feet high.

Seed was sown on 19th June, 1933. Growth was fairly good at the start and it improved very much to produce dense tufts two feet high and with a spread of about two feet in six months when it started setting seed and has continued to do so up to the present (April 1934). The Desmodium which occurred between the tufts of the grass showed poor growth.

Cattle eat it at all stages of growth but more readily before flowering. Its yield is fairly high. It is a promising pasture grass.

31. *Sporobolus diander* Beauv. is an indigenous grass very common throughout the Island. It is widely distributed in Tropical Asia and Australia. It is an annual or perennial tufted grass with stems one to three feet high.

Grown from divisions of the plant it started well and after five months it had formed tufts two to three inches in diameter and one to two feet high, from when it has been continuously setting seed up to April 1934. The Desmodium growth in between the tufts was poor.

It is readily eaten by cattle particularly when the leaves are young. Its yield, however, is rather small. It is a fairly useful pasture grass.

32. *Stenotaphrum dimidiatum* Brongn. is an indigenous grass common in the hotter ports of the Island, especially by roadsides and in the shade. It is known as *Potu-tana* in Sinhalese. It is widely distributed in South India, Siam, the Mascarene Islands, and East Africa. It is a perennial long-creeping grass forming a dense sward.

Its growth from the planted cuttings was good from the start and it kept on growing well to form a thick sward up to a foot high. It set seed from January to March 1934. It killed out the Desmodium.

Cattle eat it but not so readily as the more succulent grasses such as 'carpet grass' (*Axonopus compressus* Beauv.). It is a promising grass specially for somewhat dense shade.

33. *Themeda tremula* Hack. is an indigenous grass abundant throughout Ceylon. It is known in Sinhalese as *Pinibaru-tana*. It occurs also in India from the Central Provinces southwards. It is an annual or perennial tufted grass two to six feet high.

Seed was sown on 20th June, 1933. Only a few seeds germinated but these grew fast and well and in six months produced large tufts about three feet high and with a spread of two feet. It set seed from January to March. The Desmodium was poor.

It was readily eaten by cattle and the yield is good. It is a distinctly promising grass especially for poor soils and dry areas.

Of the indigenous grasses under trial described above *Paspalidium flavidum* A. Camus, Etora (S.) or 'Couch Grass' (*Panicum repens* Linn.), Pinibaru-tana (S.) (*Themeda tremula* Hack.) and *Brachiaria distachya* Stapf are very promising pasture species; *Amphilophis pertusa* Stapf, Guruval (S.)

(*Digitaria marginata* Link.), Rat-tana (S.) (*Ischaemum ciliare* Retz.), Rila-rat-tana (S.) (*Ischaemum timorense* Kunth), *Hemigymnia javanica* Alst., *Panicum trypheron* Schult., Potutana (S.) (*Stenotaphrum dimidiatum* Brongn.), *Apluda mutica* Linn. and *Paspalum Metzii* Steud. are all promising pasture grasses; *Alloteropsis cimicina* Stapf shows some promise so far; the common Arugam-pillu (T.) or 'Doub grass' (*Cynodon Dactylon* Pers.) does not give a sufficient yield to warrant its cultivation without manuring under Peradeniya conditions. A higher yielding strain of this species collected at Polonnaruwa in December, 1933, is being multiplied for trial here; *Echinochloa colona* Link. has not been a success on the trial plot perhaps owing to the poor soil but plants growing wild at Peradeniya show more vigorous growth and are much larger plants producing a greater quantity of leaf and stem; Bela-tana (S.) (*Eleusine indica* Gaertn.), *Dactyloctenium aegyptium* Richt., *Sporobolus diander* Beauv., Kavalu (S.) (*Setaria glauca* Beauv.) and *Digitaria longiflora* Pers. do not appear to be of much use for cultivated pastures; *Eragrostis pilosa* Beauv. and *Eragrostis tenella* R. and S. appear to be useless for cultivation as pasture grasses; *Oplismenus compositus* Beauv. too has been a failure here.

Of the naturalised grasses Pol-tana (S.) or 'Carpet grass' (*Axonopus compressus* Beauv.) chiefly and 'Sour grass' (*Paspalum conjugatum* Berg.) are two very important pasture grasses; 'Natal Red Top grass' (*Rhynchelytrum roseum* Stapf et Hubbard) appears to be a useful pasture species.

Of the introduced grasses 'Kikuyu grass' (*Pennisetum clandestinum* Hochst.) is an excellent grass for pasture purposes; Kolukattai pillu (T.) or 'African Fox-tail' (*Cenchrus ciliaris* Linn.), 'Star grass' (*Cynodon plectostachyum* Pilger), 'Prostrate Paspalum' (*Paspalum dilatatum* Poir.) *Danthonia semiannularis* R. Br. and *Polytrias amaura* O. Ktze. are all promising pasture grasses.

In considering the brief notes on the individual species given above one may be led to think that an undue degree of optimism attaches to the opinions expressed on their suitability for pasture.

To remove any misapprehension it may be mentioned that these grasses have not been taken at random but that they have been selected as they showed some degree of promise in their wild state. Most of them have also been considered suitable for pasture or fodder by various observers. It has not been possible

for various reasons to include all the species that one would have liked to try. Certain other grasses that have been tried have not been included in the trials so far.

It may also be mentioned that the land here is well drained and is flat in certain plots while in others it is sloping. The soil is sandy with much mica in it and is very poor in organic matter. It is an acid soil with a pH value of about 6·0 and in this respect it is like most Ceylon soils.

The rainfall figures for the period of the trial were: 1933, June 9·4 in.; July 9·9 in.; August 8·4 in.; September 8·9 in.; October 10·9 in.; November 10·7 in.; December 2·2 in.; 1934, January 5·6 in.; February 4·2 in.; and March 9·0 in. The plots are situated at an elevation of about 1,550 feet above sea level. The climate here is warm and moist with an average temperature of 76°F.

It is desired to emphasize that the opinions given on the suitability of the individual species for pasture are only preliminary ones based on the results of these trials so far as they can be seen at these early stages of the experiment and that they apply to the species as grown under these environmental conditions. It should also be remembered that different strains of the same species vary very greatly in their usefulness as pasture grasses. It will thus be seen that the opinions expressed may have to be revised as a result of further experiment. The chief reason for recording the trials at this stage is to show what is being done. It is hoped from time to time to indicate further observations and the progress of the experiment.

REFERENCES

1. Ferguson, W.—Gramineae, or grasses indigenous to or growing wild in Ceylon.—Journ. Ceylon Branch Royal Asiatic Society, VI. (No. 21), pp. 53-90; VI. (No. 22), pp. 1-28. Reprinted Colombo 1886.
2. Ranga Achariyar, K.—A Handbook of Some South Indian Grasses, Madras, 1921.
3. Duthie, J. F.—The Fodder Grasses of Northern India.—Roorkee, 1888.
4. Haines, H. H.—The Botany of Bihar and Orissa.—Part V. London, 1924.
5. Hooker, J. D.—A Handbook to the Flora of Ceylon by H. Trimen, continued by J. D. Hooker.—Vol. V. London, 1900.
6. Breakwell, E.—The Grasses and Fodder Plants of New South Wales. Sydney, 1923.
7. Gill, G. A.—The Germination of Paspalum Seed.—The Rhodesia Agricultural Journal Vol. XXXI. No. 2, February, 1934.

RUBBER

THE USE OF IMPROVED PLANTING MATERIAL

DR. P. J. S. CRAMER.

FORMERLY DIRECTOR OF THE GENERAL EXPERIMENT STATION, BUITENZORG

I. THE PRESENT SITUATION

SINCE the time when a few people first thought of the possibility of budgrafting rubber which we may consider to have happened about 1915—the practice of improving planting material by this method has found a widespread application. We have seen it going through the experimental stage and passing into common planting technique, where it has reached its own, and important, place since about 1927-28. The present situation of the rubber producing industry is such, that for a couple of years now practically no new land has been opened and planted under it, except perhaps a few extensions mainly meant for trying out new systems of improving the planting material on a commercial scale. The time therefore seems very appropriate to review the situation for a moment and see what the past few years have taught us. I may say that I am in a somewhat privileged position for doing this, coming out as I do every year for several months to the East to visit plantations as well as experiment stations engaged in rubber production and research work relating to it in the various principal rubber producing countries—Malaya, Sumatra, Java, Indo-China, and occasionally also Ceylon. I can follow the development of the technique, its consecutive items, and so to say, see every year the new annual ring, which experiment and research practice and experience, have put on the tree of knowledge.

A few figures may at first give us an idea of the importance of budgrafting. From reliable sources we may estimate that the present area under budgrafted rubber is now in round figures

Java	... ...	50,000 acres
Sumatra	... ...	300,000 ,,
Malaya	... ...	200,000 ,,
Indo-China	... ...	90,000 ,,
Various other countries		5,000 ,,
		645,000 acres

The oldest areas are probably in Sumatra and Java; and in those countries the practice of mixing clones, sometimes a large number of different clones, sometimes clones and improved seedlings, continued more especially up till 1931, and even up till now. In Malaya several large groups of estates embarked on monoclonal planting from the beginning of 1928 onwards. Indo-China, where the first budgrafting on a commercial scale (and still a small one) dates from 1929 and where only since 1930 large areas of budgrafts were established, has practically only applied the monoclonal system.

It is difficult to say, how this area will affect the future economies of the rubber market. The average yield per acre for adult budgrafts may be estimated at least twice the normal yield from common plantings, but for the best clones, planted by the best methods, one would think, that an average of much more may be expected and that an annual crop of three-quarters of a ton per acre or even more seems quite probable. We may expect to see a quantity of 300,000 to 450,000 tons coming to the market from the budded area when it will be in full bearing, with a cost of production much below the average for common plantings; in many cases probably only half of the last figure.

A common question in connection with the present area of budgrafted rubber is: what are the yields per acre for large extensions ? Up till now very few figures have been published: one of the few exceptions being a couple of articles in "De Bergcultures", a weekly agricultural review published in Java, and in the "Rubber Archief". The scarcity of data can be easily explained by the present situation of the industry. The main country from where the figures should come, Sumatra, is badly hit by the slump, the estates are understaffed and there is little tendency to figure out and publish results of new plantings. In Malaya a few fair sized areas have recently been put into tapping and it is hoped that from these the figures will be made available to the public. Where I have been able to see figures for larger areas they have always been equal to those reached by the yields of the small sets of trees used for the first experimental tappings. Also the fear that the yield would go back with age is contradicted by the experience, for instance, with buddings dating from the beginning of 1918, which are still keeping up or even increasing their yield figures.

Yield is, of course, the primary character to study in a clone—among the sets of buddings of the same clone, which have now been under observation in the principal countries for 8-10 years, we find some, that give individual yields per tree of 30 lb. per annum. A couple of Java clones, for instance B.D.5. and several Malayan clones have reached this figure. Most of the popular Sumatra clones do not come up to that level, but, as clones of a medium productivity, give yields oscillating around 15 lb.

If it has been once decided to embark on budgrafting, this point, the careful choice of the clone, has often been treated too lightly. We can deduct that from the fact, that often clones were highly spoken of one year, which in the following years were going to a place in the second rank. Avros 50 for instance was at one time in 1928-1929 the favourite. Its popularity then may be explained by the fact that it has many good qualities especially for a place where budding is first embarked upon, buddings take easily, the growth in the first years is excellent, the budwood gives a high number of buds per yard, the healing of the union is soon perfect. When, however, it comes to yield, it is not equal to a clone like 152, which in the beginning gives trouble, requiring a lot of pruning, presenting a knotty stem, and giving more failures. The yield of 152 however, comes up to a much higher figure than with Avros 50. So, each clone knew more or less its year of popularity, after Avros 50 in Sumatra Avros 256 was very popular among planters. It suffers, however, from the same fault, for several years the yield remains at about the same level of 15 lb. per tree.

(To be continued.)

CLUBROOT AND ROOT KNOT DISEASES AND CONTROL METHODS*

CLUBROOT has been known for more than a century in Europe, where it is wide-spread and destructive to cabbage, cauliflower, rutabaga, and turnip. It is also known in other parts of the world, especially in the United States, where it is wide-spread. As a rule it is most troublesome in the market-gardening sections around large cities, but in recent years it has become of increasing significance in many larger cabbage-growing regions. The disease affects a large number of wild and cultivated crucifers.

CHARACTERISTICS OF CLUBROOT

The outstanding symptom of clubroot is the abnormal enlargement of the roots. These enlargements may occur on the very small roots, the secondary roots, the taproot, or the underground portion of the stem. The rootclubs are often thickest at the center, tapering spindlelike, toward either end. The normal processes of the roots are of course disturbed by this malformation. Moreover, as the enlargements are less protected against secondary soil organisms, clubbed roots commonly decay before the end of the season.

The effect of this root disturbance is eventually to stunt the plant. This stunting does not always occur promptly, however. A seed bed, for instance, may show no evidence of disease in the aboveground parts of the plants, but when the plants are pulled they may be found to have fair-sized rootclubs. Likewise, infection occurring in the main field may easily escape notice because the stunting of the plants is often very slow and gradual. Mildly affected plants may form fair-sized heads. If the environmental conditions favor rapid development of the disease the stunting may be sudden and pronounced, and the plants may wilt during the middle of bright days. Permanent wilting may accompany advance decay of the enlarged roots.

CAUSE OF CLUBROOT

The direct cause of clubroot is a minute organism, one of the slime molds (*Plasmodiophora brassicae* Wor.), the spores of which remain in the soil for long periods of time. With favorable temperature and moisture some of the spores germinate, and each gives rise to a small motile body which penetrates the underground parts of the cabbage plant. Once within the host, it enlarges, probably divides, and progresses slowly through the tissue. The presence of the parasite stimulates abnormal growth of the affected parts, but the normal development of the water-and food-conducting vessels is inhibited. The clubbed roots therefore do not function properly, while their abnormal growth draws the sugar made in the leaves and diverts it from its normal storage place, such as the cabbage head. Later the clubroot organism divides into innumerable individual spores, which are so constituted as to be able to withstand long periods of unfavourable weather. They are returned to the soil when the cabbage roots rot.

* Extracted from the United States Department of Agriculture Farmer's Bulletin No. 1439.

CONTROL OF CLUBROOT

Clubroot is one of the most difficult diseases to control. The spores of the organism are so resistant to extremes of cold and drought and are so long-lived that soil once contaminated ordinarily remains infectious for many years. This makes the elimination of the disease by the ordinary procedure of crop rotation extremely difficult. For this reason the most important factor in its control is the avoidance of its introduction. If, unfortunately, it is introduced, it is important to confine it to a limited area. For this reason all that has been said above with regard to selection and sanitation of the seed bed applies especially to clubroot. So far as is known, the organism is not seed borne.

But if even a small amount of infection is found in the seed bed, it is dangerous to use any plants from such a bed for transplanting, since even though apparently clean plants are sorted out, infested soil is likely to be carried with such plants to the main field and thus infest otherwise clean soil. The spores are carried with surface drainage water, and therefore areas that are subject to drainage from an infested spot are also likely to be unavoidably contaminated. Thus, infested areas should be abandoned indefinitely for cabbage and other related crops.

The application of hydrated lime to infested soil sometimes reduces the severity of clubroot, and its use has been widely recommended as a remedial measure. Recent studies, however, indicate that successful control varies with climatic and soil conditions. The desirability of using hydrated lime should therefore be determined by a preliminary trial and its demonstrated effectiveness in the particular locality.

Certain varieties of turnip are rather resistant to clubroot. No varieties of cabbage are known to be resistant.

ROOT KNOT CAUSED BY NEMATODES

In trying to distinguish between root knot and clubroot some confusion is likely to result. Although the organisms causing the two diseases are quite different, the effects produced on the roots bear some points of resemblance. Root knot is generally characterized by smaller swellings than clubroot, and infection as a rule is more uniformly distributed on the lateral feeding roots. If, upon breaking open the swellings on the roots, pearly white bodies about the size of a pinhead are found, root knot is to be suspected. These white specks with the swelling are the enlarged egg-bearing female nematodes or eelworms, which cause the disease. The interior mass of clubroot is slightly pinkish or brick-colored. Root knot effects a great variety of unrelated plants, while clubroot, so far as is known, occurs only on crucifers.

CONTROL OF ROOT KNOT

Crop rotation has been found to be the most practicable means of controlling this disease, the object being to use crops immune or resistant to root knot for the purpose of starving out the eelworms. When this method of controlling disease is employed, a rotation of at least 3 years, accompanied by clean cultivation to keep down weeds, should be practised. There are more than 500 different species of plants already known to be susceptible to root knot, among which are many cultivated plants and numerous weeds.

The following lists of the more important immune or highly resistant crops and of the crops and weeds known to be susceptible to root knot and therefore to be avoided on infested fields will be of assistance in planning rotations for the reduction of the trouble.

CROPS LARGELY OR ENTIRELY IMMUNE TO ROOT KNOT

Barley
Beggarweed, Florida
Chufa
Corn
Cowpea, Brabham
Cowpea, Iron
Cowpea, Monetta
Cowpea, Victor
Crabgrass
Grass, Bermuda
Grasses (nearly all)
Kafir
Millets (nearly all)
Milo
Oats, winter
Peanut
Rye
Sorghum
Soybean (Laredo variety only)
Velvetbean
Wheat.

CROPS SUSCEPTIBLE TO ROOT KNOT

Alfalfa
Asparagus
Bean, lima
Bean, snap
Beet
Bur-clover
Cabbage
Carrot
Celery
Collard
Cotton
Cowpea (all varieties except Iron, Brabham, Monetta and Victor)
Cucumber
Eggplant
Fig
Lettuce
Muskmelon (cantaloup)
Okra
Pea, garden
Peach
Potato
Radish
Salsify
Soybean (all varieties except Laredo)
Spinach
Squash
Strawberry
Sugarcane
Sweetclover
Sweetpotato
Tobacco
Tomato
Vetch, common
Watermelon.

WEEDS ATTACKED BY ROOT KNOT

Balloonvine
Fennel, sweet
Maypop (passion flower)
Mexican-clover
Mayweed
Papaya (melon papaw)
Purslane

On fields badly infested with root knot nematodes, only immune or highly resistant crops should be grown.

If the disease occurs in the seed bed or in the greenhouse, the soil should be sterilized by live steam.

DESCRIPTIONS OF TYPES OF PRINCIPAL AMERICAN VARIETIES OF TOMATOES*

DEVELOPMENT OF IMPROVED VARIETIES IS NEEDED

THE describing in this publication of the few dominant varieties of tomatoes must not be interpreted to mean that these varieties meet all possible requirements of the trade perfectly and that new and improved varieties are not needed. These definitions of the present most important varieties should in no way discourage the breeding of new and distinct sorts, so long as the new kinds are really different and really better than those now existing. There is no merit in a new variety merely by virtue of its being different from others; it must meet specific requirements that other varieties cannot meet, if it is to deserve consideration. Furthermore, an improvement in yielding capacity alone, or in yield and uniformity, of one of the present types is not justification for claiming it as a new variety. Differences should be qualitative (differences in kind, with reference to a character or characters) as well as quantitative (differences in degrees) and must be such that they can be clearly described and easily recognized.

WHAT THESE DESCRIPTIONS WILL ACCOMPLISH

It is hoped and generally believed that the publication of these descriptions will have several desirable results: (1) All stocks of seed of the varieties described can eventually be made to approach the established and generally recognized type, with the result that varieties can be ordered by name with confidence that the desired type will be obtained; (2) thorough familiarity with the important varieties for which types have been established and adequately described will facilitate detection of misnamed and renamed stocks; (3) familiarity of the buying public with the few really different and important varieties that are required to meet most general market and home-garden demands should eliminate from present seed lists hundreds of names of so-called varieties which often are not distinctly different and rarely are superior to good strains of established sorts. If growers learn the merits of the standard varieties and cease demanding the numerous things of minor importance it will be practicable for the seed grower to reduce the number of stocks that he must carry in order to meet buyers' demands. This in turn will simplify production and handling and will permit the seed grower to devote more attention to the chosen varieties, with a resultant improvement in commercial stocks.

It must be emphasized, however, that the attainment of these objectives is dependent upon the entirely voluntary action of all persons concerned. Growers and seedsmen have expressed their desire for such a definition of varieties as is here presented, in the belief that it would guide

* Extracted from the United States Department of Agriculture Miscellaneous Publication No. 160, October, 1933.

them in their informal, voluntary co-operative efforts to accomplish the unquestionably desirable ends outlined above.

EFFECTS OF ENVIRONMENT

All descriptive terms and values presented here, unless otherwise stated, apply to the standard or type of the variety in question as it appears under most conditions where that variety is grown. The descriptions apply to plants grown without pruning. Extreme variations in a character which result from obviously unfavourable conditions were given little weight in establishing the limits of the standard type. Likewise, if a certain location or season produces unusually favourable results with reference to size, quality, yield, or other factor, with results that reasonably cannot be expected year after year or in other regions, those results are considered not typical and so were given little weight. However, extremes of behaviour were considered, and special mention is made of them when necessary to fulfil the objects of this work.

TIME OF MATURITY

As the effects of temperature and moisture upon the rate of plant growth and development are generally recognized, it should be readily understood why, in describing the standard for a variety, rather wide limits are allowed for its time of development in different regions

Under certain exceptional conditions of climate and methods of culture all the varieties described may bear the first ripe fruits at practically the same late date and reach their respective peak harvest within a week of one another. In parts of western Texas, for example, high temperatures and low humidity prevail for a considerable period, with the result that no fruit is set, but vegetative growth continues vigorously. With the arrival of weather that is cooler and otherwise more favourable, fruit setting begins with all varieties more or less simultaneously. The time required for the development and ripening of fruits after fruit setting does not vary markedly among varieties; and therefore both early and late varieties simultaneously may ripen. The varieties more resistant to these unfavorable conditions will of course bear the larger yields of early fruit.

SIZE OF PLANT AND LEAVES

Typical plants can be expected only on lands fertile enough to produce normally profitable yields of the crop in question and under conditions of management and weather that experience has shown usually produce favorable results. Good judgment and a spirit of fairness must be used in considering such factors before a stock is condemned as being off type or before a bad stock is defended on the ground of unfavorable environment.

In general, leaf characters of any variety are rather variable, and by themselves are of little or no value in identifying a variety. The appearance resulting from habit of growth of the plant is usually rather characteristic and is often a good basis for identification of certain varieties, but leaf characters alone must not be confused with the total effects of plant habit and color that give a variety a characteristic appearance.

Size is probably the most variable character. Poor soil or drought obviously may result in sizes of entire plant and sizes of leaves that are below those indicated for the ideal type. Very often these conditions not only decrease the size of plants but also alter rather markedly the general appearance of the plant as a whole. Environment conducive to excessive vegetative growth may result in such rank leaf and stem development as to change characters other than size, making accurate identification very difficult. These conditions are usually accompanied by a greater number of branches than is typical for the variety in most regions. This effect is less commonly found than variations in size but must be taken into account whenever a stock appears to be off type. Under low-temperature or drought conditions leaf development tends to be sparse, resulting in exposure of the fruits to the sun. Dry weather and other factors conducive to poor growth also result in leaves being narrower in proportion to their length than under more favorable conditions. With an abundance of moisture, fertile soil and temperatures that result in excessively large vine growth, the plants generally tend to be more sprawling and therefore spread farther than usual in proportion to their height, but not always are the plants more sprawling under such conditions of soil and climate. In some regions, as in southern Texas, the plants are set rather closely in the row to afford mutual protection from the wind and to increase the shading of the fruits from the sun. When this is done, the plants are taller and more erect than is typical of most varieties. At the same time the maximum spread is also greater than usual. The foliage of such plants is usually extremely heavy, hiding the fruits from view early in the season. Such plants of some varieties are often unproductive because the factors causing excessive plant growth are also conducive to unfruitfulness. On the other hand, unfavorable weather conditions which destroy or prevent the set of fruits on the first few clusters may be followed by an excessive vine growth which is not characteristic of the variety.

SIZE AND SHAPE OF FRUITS

As stated previously, actual size usually varies much more than do the proportions or shapes of the plant or individual parts of the plant. The effects of poor soil or climate upon size of fruits is too commonly observed to require discussion. Under conditions which prevent the attainment of desirable size of fruits and which retard plant growth, fruits are often deeper, that is, the polar diameter is greater in proportion to the equatorial diameter than usual. On the other hand, if there is excessively rank growth of plants the fruits often are of an abnormally large diameter in proportion to their depth, and therefore proportionally flatter than usual. Such flattened fruits are usually distinctly rougher in appearance, have deeper cavities and basins than is typical, and also very pronounced creases and ridges.

Although these differences in fruit shapes under different degrees of moisture, fertility, and temperature are pronounced in extreme cases, they are not so great under good tomato-growing conditions as to preclude the possibility of identifying the varieties listed. The fruits of most varieties tend to be slightly proportionally deeper in the Northern States than in the Southern and Pacific Coast States. This difference, however, does not appear to be so great as to make impossible the development of a

single stock which will meet the description of the variety over a wide range of conditions. Tomatoes are grown in semiarid, hot south-western regions to which they are not well adapted and where excessive vine growth and low yields prevail. Under these conditions many varieties appeared very different from the same varieties in certain other parts of the United States and could hardly be identified by previously existing descriptions. Special consideration has been given to such instances. The allowable limits of variation set forth in the descriptions are designed to include the slight unavoidable differences that exist between different regions and under different conditions of soil fertility.

NUMBER OF FRUITS PER CLUSTER

The figures given upon the number of fruits per cluster in the ensuing variety descriptions will appear abnormally low to persons accustomed to counting fruits on staked and pruned plants. It must be understood that these counts are based on plants allowed to grow freely on the ground without pruning or staking and are based upon counts made under a wide variety of conditions over a period of two years.

COLOR

Marked plant-food deficiences will result in poor color of foliage. In general, a lack of nitrogen causes lighter greens than are typical for the several varieties; on the other hand, a marked shortage of phosphorus or potassium often results in a darker green than usual. Excessively dry conditions will result also in a lighter color of foliage when plants are viewed from a distance, this effect being due chiefly to the curling of leaves and the showing of the lighter-coloured under surfaces. A slight bloom may also develop upon the leaf surfaces during a period of drought.

Typical colors of fruits have been recorded for the full-ripe stage rather than the stage ripe enough for picking for market, except for the varieties Globe and Gulf State Market. Both of these stages of ripeness are indicated for these varieties, tomatoes as ordinarily harvested are not fully ripe and so should not be compared with the color values given for fully ripe fruits.

It has been found that the red color in the tomato fruit does not always develop well at temperatures above 86°F. Under abnormally high temperatures or exposure of the fruits to the sun the characteristic rich color of the variety may not develop. Varieties that are of a rich, brilliant scarlet color in the middle and northern regions of the country often tend toward grenadine under the high summer temperatures of the South and South-west.

IMPORTANT CONSIDERATIONS IN COMPARISIONS OF TOMATO STOCKS OR STRAINS WITH THE PUBLISHED STANDARDS

In addition to considering the points brought out under the heading Effects of Environment, it is necessary to observe certain precautions in making comparisons between varieties or between a variety in the field and the description of the standard in the following pages.

Varieties to be compared must be grown under as nearly identical soil and cultural conditions as possible, especially if earliness and yield are important. Close comparisons should not be attempted between rows widely distant in the field unless duplicate or triplicate plantings are made.

All varieties must be planted at the same time and transplanted to the field on the same day if possible.

Plants for transplanting must be carefully grown so that all lots have an equal chance for making a strong, stocky growth. They should be transplanted when 4 to 6 inches tall and before any blossoms appear.

In general, the plants should be given sufficient space in the field so that the branches of adjacent plants will not meet in the row until after harvesting is well under way.

Plant habit can best be observed about the time the first fruit ripens. Later than that the weight of the fruits usually pulls most of the branches down to the ground, destroying the characteristic habit of growth of the variety. Disturbance of the plant in harvesting the fruit, advancing age, and the occurrence of pests, diseases, and unfavourable weather all tend to destroy certain characteristic features, thus making plant identification difficult or impossible late in the season.

The time of appearance of the first individual ripe fruit in a strain is not a good index of earliness. Earliness should be based on the time required for enough fruits in a strain to attain ripeness to yield at a rate comparable to one or more commercial harvests.

OUTSTANDING CHARACTERISTICS OF THE PRINCIPAL VARIETIES OF TOMATO

Item	Earliana	Bonny Best	Gulf State Market	Globe	Marglobe	Early Detroit	Greater Baltimore	Stone	Santa Clara
Chief use	Home and market	Home and market	Market	Market	Market canning	Market	Canning	Canning	Canning
Season	First early	Second early	Early mid-season	Midseason	Midseason	Midseason	Late mid-season	Late	Late
Time from transplanting to harvest (days)	55-65	63-73	66-76	70-80	70-80	70-80	73-83	75-90	85-100
Plant size	Small	Medium	Medium	Large	Large	Medium	Large	Large	Large
Leaf size	do	do	,, large	do	do	,, large	Medium large	Very large	do
Leaf color (green)	Medium	do	Light	Light	Medium	Medium	Medium	Dark	Medium
Growth habit	Sprawling	Semierect spreading	Semierect spreading	Semierect spreading	Semierect	Semierect spreading	Semierect spreading	Erect	Sprawling
Foliage density	Open	Slight	Medium	Medium	Dense	Dense	Dense	Very dense	Dense
Immature fruit color	Green streaked	——	——	——	——	——	——	——	Green streaked
Fruit size ounces	4½-5½	4½-5½	5-6	6-7	6-7	5½-6½	6-7	6½-7½	9-12
Fruit shape	Deep oblate	Deep oblate	Globular	Globular	Globular	Flattened globular	Flattened	Deep flattened	Flattened
Corky ring	Inconspicuous	Inconspicuous	Conspicuous	Negligible	Conspicuous	Conspicuous	Conspicuous	Conspicuous	Conspicuous
Stylar scar	Medium	Mere dot	Small	Small	Small	Medium	Large	Medium	Very large
Outside color	Scarlet with yellow	Grenadine red	Scarlet red	Scarlet red	Scarlet with grenadine	Scarlet red	Scarlet	Scarlet	Scarlet
Inside color	Scarlet red with orange	Medium scarlet red	do	do	Scarlet red	do	Scarlet red	Scarlet red	Scarlet red
Cells number	10-12	6-7	5-6	5-6	6-7	6-7	7-9	7-9	15-25
Cell arrangement	Irregular	Regular	Regular	Regular	Regular	Regular	Irregular	Irregular	Regular and irregular

PLANNED ECONOMY AND AGRICULTURE*

SINCE the war, the world market has been rapidly breaking up owing to the development of particularist national policies aimed at economic self-sufficiency and independence. Even before the present depression began, the destructive effects of these policies upon production and trade made themselves painfully felt, and the means by which the situation in this respect could be improved occupied the attention of the World Economic Conference of 1927. The depression, which began in 1929, greatly accelerated this process of dissolution by forcing the Governments, even in countries traditionally bound to Free Trade, to adopt protectionist measures and, in face of falling prices, financial difficulties and growing unemployment, to extend the scope of Government control over economic activities.

Economic life practically everywhere became increasingly the concern of Governments, and the idea of planned economy, which, hitherto, had been mainly the subject of academic discussion, began rapidly to gain ground as a vital issue of practical politics.

In the course of the last few years the world has made great strides in the direction of planning and deliberate control of economic activities. In the general confusion into which the economic system was plunged, especially since the financial crisis of 1931, the growth of planned economy is a feature which stands out clearly, as a definite landmark. The world has turned to planning as a solution of its economic and social problems, and in the economic background of the present agricultural situation planned economy accordingly, occupies a prominent place. The advent of planned economy, though it is often expected to solve our present problems, tends, however, to create problems and difficulties of its own; and these problems and difficulties will have to be briefly outlined below.

CHAPTER I

THE PROBLEMS OF PLANNED ECONOMY

As an element in the structural transformation of the economic and social system of the modern world, the growth of planned economy, which encroaches to an increasing extent upon the field of free competition, is a phenomenon of fundamental importance. The application of the principle of deliberate planning and control to an increasingly large sector of the economic system constitutes, in fact the negation of the very essentials of competitive economy, on which our current economic conceptions are based. The advent of planning, therefore, is nothing short of the beginning of a new economic era, in which equilibrium, hitherto the ideal goal of the competitive system, always striven for and never attained, becomes the solid corner-stone of an economic structure carefully planned and calculated in advance. Yet the transition to planned economy proceeds by a succession

* By George Pavlovsky in *International Review of Agriculture*, Year XXV, No. 1, January, 1934.

of steps, so small, and so apparently lacking in co-ordination, that the nature of the change it involves is not always fully realised. Accordingly even in the course of important discussions, we are still liable to deal with economic problems in terms of competitive economy, which has largely ceased to function. A case in point, perhaps the most conspicuous of all, is the treatment of the question of return to the international gold standard, in which the utter incompatibility of an effective gold standard with an economic organisation in which prices are subject to deliberate control by all the means at the disposal of the modern State, seems to be entirely left out of account.

The actual situation, which became especially clear and pronounced in 1932-33, is that of a world in a state of transition. The old competitive order is rapidly crumbling away, while the system which would appear to be called upon to take its place is only just feeling its way and is being evolved empirically. Though indeed the general principles of planned economy are a fashionable subject of discussion, its practical implications are still very far from being fully realised.

In some countries, indeed, planned economy is being introduced not only as an empirical expedient dictated by circumstances, but as a deliberate scheme of economic and social reconstruction as well; but even there its actual putting into effect has largely the same tentative and empirical character. This applies even to so far-reaching and revolutionary a transformation as the Communist experiment in Russia, which has involved a succession of advances and retreats. The reconstruction programme of President Roosevelt, since its principal features were outlined by him in "Looking Forward", has been evolved empirically, in answer to situations which demanded action. Though the principle of planning and deliberate control of economic activities forms an integral part of the Fascist conception of the Corporative State in Italy and of the National Socialist programme in Germany, the actual progress to the goal in both cases is purely empirical. Most other countries in the course of the last few years, have introduced important elements of planning and control into their economic life, with the result that planned economy has deeply penetrated into the competitive system everywhere, and is rapidly accomplishing from within its work of disruption. Yet, it may be said that, with the only exception of Russia, in which planned economy originated from a complete political, social and economic revolution destroying the very foundations of the Capitalist system, planning is not so much being adopted with a view to giving effect to some deliberate scheme of reconstruction, as forced upon both Governments and producers by their critical situation.

Werner Sombart, the greatest living philosopher of Capitalism, sees in planned economy the natural and unavoidable completion of the historical process of evolution of the modern economic and social system. And indeed, when we consider the way in which planning gradually replaces competition as the motive power of that system, we have the impression not so much of the deliberate creation of a new order, as of a process of natural growth. Yet even if the substitution of planning for competition is a natural stage in the evolution of modern Capitalism, like many other natural processes it is not accomplished smoothly and painlessly; nor does it necessarily imply a change for the better, leading to larger national incomes and higher standards of life. It may even be said that,

unless and until some of the problems created by the transition to planned economy find a satisfactory solution, the reverse is more likely, and the standards of life will generally be lowered as compared with those attained under the competitive system.

At the bottom of the diminution of national income which would appear to be unavoidable under a system of national planning as at present conceived by countries striving "to put their own house in order first," lie the particularist tendencies inseparable from such planning. Planned economy is defined by Sombart as being essentially national, and from what one is in a position to observe now, as to its origins and its nature, this definition would appear to be amply justified by facts. As a rule, in every country in which planning has been put into effect in the course of the last few years, the transition has been preceded and accompanied by the adoption of strict protectionist policies which more or less completely isolated the home markets of the countries concerned from outside influences. Technically, indeed, in order to obtain complete control over national economic activities, a country has to cut itself adrift from the world market, unless its relations with the outside world can be fitted into its system of planning. Under a system of national planning, therefore, international economic relations are necessarily restricted, the system of world economy being broken into a number of more or less effectively closed national units. The competitive organisation of the world market is being destroyed, without, so far, its being replaced by any other comprehensive scheme of international economic relations, which could ensure to the national economic units some at least of the advantages they enjoyed as parts of a world-wide economic whole.

Of the restriction of outlets involved in a transition to planned economy within closed national frontiers the world has lately been made very painfully aware, since the returns of national industries and the standards of well-being have been severely lowered everywhere.

In a closed national economy, however well managed, production ceases to be governed by considerations of relative costs and returns, as it is governed in a system of competitive world economy. If and when, as under present conditions, the purely economic criterion of relative costs is replaced by other considerations, such as the achievement of the self-sufficiency and of internal equilibrium within closed national frontiers, the income derived by the community from production is bound to suffer a diminution since labour and capital are necessarily diverted from occupations in which they could obtain the highest returns to less remunerative employments. The aggregate national income is thus reduced, and with the reduction of the national dividend the standards of life cannot possibly be maintained at their former level. If and when the all-round lowering of the standards of life is prevented, as it often happens, by the organised resistance of certain powerful groups of interests, a certain part of the productive equipment of the country and of its working population has to forego its share in the national dividend altogether, by being driven out of employment, or has to bear more than its due share of the sacrifice.

Apart from the diversion of productive forces to less remunerative employments, the efforts aimed at achieving an independent economic balance within a closed national economy brings into play another factor

which also tends to reduce the national dividend. The whole trend of modern industrial development has been towards standardised mass production, and both the size and the output of industrial concerns have been increasing continually. The very existence of modern large-scale industry has come to depend upon world-wide outlets or at least upon vast facilities for foreign marketing. All the development of industrial technique has been proceeding in this direction, forcibly driving the producer towards new outlets. In a world broken up into a number of more or less isolated national economies, the industries which have grown up under conditions of world-wide competition, have to depend, in the main, upon the purchasing capacity of their respective home markets: a purchasing capacity which, moreover, has been reduced by the diversion of productive forces from the more remunerative occupations to employments dictated by national policies. Consequently, the paying capacity of industries in a closed national economy however efficiently this may be planned and run, cannot be maintained at their former level, and the possibilities of industrial expansion are bound to be severely restricted.

No branch of production, industrial or agricultural, can escape the direct and indirect effects of this policy of isolation. In agriculture they directly involve a reduction of returns due to the diversion of labour and equipment to less remunerative employments, in which production has usually to be subsidised at the expense of the community. Indirectly, agriculture feels the effects of the general reduction in the purchasing capacity of the consumers involved in the diminution of the national income. These effects, indeed, the farmers have been painfully feeling in the course of the last few years, especially in the fall of the prices of those of their products for which the demand is highly elastic.

Under such conditions, unless the country concerned is exceptionally fortunate in possessing resources which permit it to produce all it needs at low relative cost, if it attempts the substitution of planned national economy for participation in the competitive world market, it must be prepared to make sacrifices in exchange for the higher degree of economic stability it seeks to attain. In actual fact, no country, however large and abundantly supplied with natural resources, unless it lives in utterly primitive conditions of natural economy, is so placed as to be able to exist in complete isolation, under conditions of economic autarchy, without considerable sacrifices in well-being.

Such sacrifices, however, even if their necessity is recognised by those those responsible for the country's economic policies, are not readily accepted by the community. In every country there is a keen struggle going on between the various interests concerned in the distribution of the national dividend, for keeping their particular shares as far as possible unaffected by the reduction: and the more efficiently these groups of interests are organised, the greater is their chance of success in the struggle. For a time at least, highly organised combinations may often succeed in maintaining their earnings and their standards of life at the expense of the less organised groups. Cartellised industries and powerful trades unions fight for themselves, and when they succeed in maintaining their positions in spite of the diminution of the national dividend they tend to upset its distribution and to shift on to others more than their fair share in the

sacrifice. Since agriculture, of all branches of production, is the most difficult to organise, it may be pointed out here that in this struggle the farmer is most likely to be worsted.

So long as this struggle goes on, internal equilibrium even at a lower level of general prosperity, cannot be achieved, and the economic maladjustments which cause depression and unemployment are bound to continue. In a period of transition from the competitive system to planned economy, therefore, the mastering of this abuse of their position and power by those combinations, which, hitherto, have been the pioneers of planning and control of production and distribution under the competitive system, is one of the most pressing and, at the same time, one of the most difficult problems of economic policy.

In order to bring the economic system under deliberate control, its scattered atoms must be organised into manageable units through combinations which if they do not exist must be created. If they exist, in the form of industrial combination or trades unions, they must be made to serve the purposes of the planning authority. Since these purposes are very different from those which the combinations concerned have been pursuing under the competitive system the enlistment of their co-operation in the work of re-organising the economic system sometimes presents great difficulties. As an example of these difficulties we may point to the opposition with which President Roosevelt's experiment in introducing the industrial codes has been meeting, and to the keen struggle which it provoked between the various interests concerned. In the Fascist conception of the Corporative State a solution of this problem is sought by placing the State as representative of the community of which all private interests are but servants in the position of arbiter whose authority, supported by all the power of organised Government, cannot be questioned. Elsewhere, though no constitutional solution of this problem has been found so far, the Governments have to intervene with all their power of compulsion, if and when the necessity of such intervention arises, owing to the inability of the parties concerned to come to terms or to their stubborn opposition to the schemes promoted by the planning authority. Indeed, under the National Industrial Recovery Act, the President is given the power to inflict heavy fines on those refusing to adopt the Industrial Code and, in extreme cases of resistance, even to withdraw the licences from recalcitrants. Yet, as the Ford case has proved, such sanctions are not always sufficient to bring powerful recalcitrants effectively to heel, even if, strictly speaking, they are not business combinations, but great individual concerns. A satisfactory solution of this problem has still to be found. It is, indeed, one of the most urgent and vital issues in the whole enormously complicated problem of transition from competitive to planned Capitalism, since on its solution hinges the basic question whether or not national planning and private interests can be combined within a workable economic system. Under the competitive systems, private interests was the motive power in any attempt of planning and control of economic activities; and since not all the important branches of production and trade were equally capable of organisation, business combinations as agencies of control of economic activities used to achieve whatever order was possible at the expense of the less organised industries. Planned economy, as the term is not applied, means deliberate control of economic activities for the benefit not of any particular group or groups of interests, but of the community as a whole;

being essentially national, it must be in a position, whenever necessary to curb any attempt at upsetting economic equilibrium within the community in the interest of particular groups. The issue is clear, but, so far, the only positive attempt at finding a constitutional solution of this vital problem is that contained in the Italian conception of the Corporative State: a solution of which the ultimate success depends upon the State, as supreme arbiter, always remaining completely independent of the interests at play and sufficiently powerful to exact obedience to its orders.

Moreover, there is the difficulty, very often considerable, of determining the real resultant of the various economic forces and interests, along which national planning must be directed. This difficulty is generally the greater, the more highly developed economically the country is, and the more complicated, therefore, its economic organisation. In all countries there would be interests which would stand to gain from the immediate effects of the transition to closed national economy. Such would, as a rule, be the position, for instance, of industries working primarily for the home market, which would thus be effectively protected from foreign competition. Such industries may later be disappointed in their expectations, owing to the reduction in the purchasing capacity of the community which may eventually result from the damage done to other industries and trades by the closing of frontiers to foreign imports and the resulting diminution of exports. In the first instance, however, the industries dependent upon the national market would welcome increased protection. On the other hand, exporting industries and trades, shipping and transport in general, as well as all branches of international finance, would generally identify themselves with the opposition and would insist upon keeping competition on the world market as far as possible free. The balance of these opposing interests in the country is often so exactly adjusted that the choice of the right policy is made difficult. Moreover, any policy once adopted, will be sure to be strongly opposed, even if, as it is now, the adoption of a policy of national isolation and planning is due not so much to deliberate choice as to the pressure of circumstances.

This internal conflict of interests makes the real position, both within the different countries and internationally, very uncertain, since there are always powerful influences which seek to reverse the process of evolution. The groups most affected by the change, and the countries in which these groups are particularly important, though they may be forced to participate in the general movement, have a tendency to look upon the present stage of economic evolution as a temporary aberration, after which there must necessarily be a return to competitive world economy; and the sooner this happens, the more rapid and the more complete they expect the recovery to be.

This is the case generally of highly developed industrial countries, with world-wide commercial and financial connections. But they are not alone in this group, to which also belong those agricultural countries which, under the competitive system of world economy, used to be their natural counterpart. For these agricultural countries, of which the very growth has been mostly due to the development in the nineteenth and early twentieth century of large industrial capitalism, the extension in Europe of self-sufficient planned national economies is an extremely severe blow. The exporting agricultural countries of the New World, in America and

Australia, with their one-sided development, both in production and in population, and their consequent lack of home marketing facilities for their products, have grown up, with the financial backing of industrial Europe, and later of the United States, under conditions which presupposed the indefinite continuance of competitive world economy, such as it was conceived in the last century. The adaptation to a new economic order, in which a large part of their production of foodstuffs and raw materials finds no market, is for them a problem of enormous difficulty, and its solution can only be achieved by exceedingly heavy sacrifices and at the price of a great lowering of the standards of life. This lowering is bound to be all the more painful, because, while the old economic order lasted, and industrial Europe absorbed increasing quantities of imported foodstuffs, the standards of life overseas have risen to a level considerably higher than that of the bulk of agricultural producers in Europe, and especially in the exporting agricultural countries of the Old World. The immigration policy adopted by certain at least of the overseas countries did not follow the example of the United States before the World War in promoting immigration and settlement as the best means of a rapid and balanced development of national resources, but aimed rather at maintaining an artificially high standard of life by limiting the supply of hands and thus creating a scarcity of labour. While production, under extensive conditions of cultivation and with the widespread use of labour-saving machinery, was thus developed, a very large output per man having been achieved, no solid foundation for a balanced economy and based upon a large internal market for all kinds of products, industrial and agricultural, has been created.

When, at the present time, the export facilities for surplus agricultural production were restricted, the whole economic structure of these countries was shattered, and the re-adjustments in it, which are necessary to meet the situation, are extremely difficult to make.

It may be said that, though the position of the exporting agricultural countries of the Old World is very difficult indeed, and though their sufferings due to the partial closing of their foreign outlets, are extreme, the position of the overseas countries is perhaps more critical still. When, indeed, it comes to going back to a large extent to primitive subsistence farming, as a measure of re-adaptation of the economic system to changed conditions and of achieving a temporary balance, an agricultural population of peasants can effect the transition much more easily than can a population accustomed to high standards of life based on an artificial limitation of labour supply and on highly commercialised production. Both these groups of agricultural exporting countries, however, are liable, as immediate effect, to lose from the closing of frontiers to their imports involved in the transformation of the world's economic organisation which is taking place. In the conflict between the principles of competitive world economy, on the one hand and of planned national economy on the other, they naturally identify themselves with the former, and we see them more or less firmly ranged with the supporters of the view that the sooner a return to competitive conditions is effected, the better.

Thus, while the process of transformation is going on everywhere and unavoidably bringing with it maladjustments and sufferings, there are powerful influences, national and international, which oppose it. Basing

themselves, upon the proposition, perfectly true in itself, that a transition to planned national economy would be bound to involve a considerable lowering of the standards of life, which have only been achieved owing to the existence of a world market, certain countries and certain groups within most countries, insist that no national recovery is possible until world economy, in its competitive organisation, is restored. Though themselves involved in the general process of transformation, they consider that the sooner it is reversed, the better, and strive, by means of international action, to effect this reversion to the competitive system.

The advocates of planned economy, whose position is much strengthened by the fact that life itself would appear to be forcibly driving the world into the direction desired by them, insist, on the other hand, on the change being final and decisive. In the midst of instability, they would point to the advantages which would accrue to the countries adopting this system from the greater economic stability it would ensure. Even should the national income and the standards of life be lowered more or less considerably, at the lower level they would attain, they would be better secured against violent fluctuations and crises. Others would point to signs of economic recovery which would often follow upon the closing of national frontiers to outside influences, accompanied by a better internal adjustment of production and distribution.

It is perfectly true that, so long as by successive increases in the system of defences which protect the home market, the price level can be maintained and sometimes even raised, there may be an apparent revival of economic activities, and the unavoidable ultimate effects of isolation may be thus more or less effectively masked. This position, however, is purely artificial and essentially precarious, since it depends upon the continuous application of stimulants in the form of increases in the protection afforded the home market by tariffs and restrictions. If and when, as is bound to happen sooner or later, foreign imports are practically excluded as a result of the gradual raising of tariffs and of the imposition of fresh restrictions, any further development in this direction ceases to be possible, and the national price situation falls entirely under the influence of home supply and demand. When, as, say, in Germany since 1931 to take the most conspicuous case, the general duty on imported wheat reaches nearly three times its c.i.f. price in London or Liverpool, and a series of other measures excludes foreign wheat from the German market except in cases of technical necessity, the limit of import restriction is reached, and prices of wheat on the national market are determined only by the home crop and by internal demand. Whatever influence may be exercised over these prices, must come from an adjustment between supply and demand: an adjustment, which is, as a rule, more readily effected by limiting supply than by increasing demand, since demand ultimately depends upon the available purchasing capacity of the consumers, and this cannot be increased at will.

In a community of which the national income is falling, a diminution in the supply of a certain product, even if it is a necessary, such as wheat, cannot be sure to produce a rise in prices sufficient to make a reduction of supply a paying proposition for the producer. The reduction, indeed, would pay only if the rise in prices caused by it were proportionately greater than the diminution in supply. Then, the aggregate sum obtained by the

producers for a diminished supply of wheat would be increased, as compared with the sum they could get before for a larger crop, and farmers would accordingly benefit by the restriction of output. In the case of a first necessary, such as wheat, an artificial scarcity may, indeed, have for immediate effect a rise in its price sufficient to maintain or even to increase the aggregate price of the particular crop affected by restriction, but this improvement is bound to be only temporary. The most likely effect of the rise in the prices of wheat during a general depression, which involves a fall in the purchasing capacity of the community, would be to diminish demand for some other less essential foodstuff by diverting the available cash resources from it to the wheat market. As a result, whatever agriculture may gain by artificially raising wheat prices, it would lose, say, on the prices of dairy products or other commodities less urgently needed than wheat. The national income of an economically isolated community is not increased by such adjustments, and any rise in prices achieved by an artificial limitation of supply of certain products, though it may benefit some particular groups of producers, can never have more than a precarious effect. Indeed, it would generally resolve itself in the end into the mere shifting of the burden of depression from one branch of production to another, and would often ultimately react upon the products of which the prices have originally been raised.

Thus, it would appear that planned economy within more or less effectively closed national frontiers, even if it constitutes an unavoidable stage in the process of evolution of our modern economic organisation, would be necessarily bound to bring about a severe diminution of prosperity. And in so far as, in the course of the last few years, there has been a pronounced tendency towards economic isolation and planned economy on strictly national lines, the effects of this tendency could be clearly observed in the universal decline of economic activities and in the all-round lowering of the standards of life.

It would appear that, apart from the other difficulties with which the reconstruction of the economic system on rational lines by the substitution of orderly planning for the chaos of competition, may have to contend, the consolidation of the new order will depend on its success in finding a solution to the problem of international economic co-operation, which alone can insure the wherewithal for the upkeep of our present standards of economic civilization. Present-day planned economy, confined within national boundaries, will not be in a position to maintain anything like the existing level of well-being and comfort, which was made possible by the existence of a world market, as an instrument of international economic co-operation. The future of planned economy will depend upon its capacity to devise and to put into effect a workable scheme of international economic co-operation between planned national economic units. Until this is achieved, the position of isolated planned national economies will remain very much like that of a private household in financial straits, in which careful planning is necessary to make both ends meet. Such planning may, indeed succeed in balancing the income and the outgoings, but not being able, without entering into business relations with the outside world, to increase the former, it will have to fall back upon the diminution of the latter.

In the next chapter dealing with present-day developments and tendencies in the evolution of commercial policies, an attempt will be made to find out whether, and if so, in what direction, a solution of this vital problem is being sought.

CHAPTER II

THE EVOLUTION OF MODERN COMMERCIAL POLICY

The origins of present-day commercial policy can be traced to the war and to its direct and indirect consequences. Though certain nationalist tendencies could already be discerned in the evolution of commercial policy before the war, the war brought about so complete a change in the conditions of international trade and has created so many entirely new problems, that subsequent developments could not be looked upon as merely a continuation of trends already present in the structural development of internatinnal economic relations.

It is true that, after the relatively short-lived triumph of economic liberalism in the sixties and seventies of the last century, in the eighties began the steady development of protectionist policies. The increase in tariffs accompanied the growth of industrial Capitalism and its spread to new countries. Young national industries had to be protected against foreign competition, and in countries which were poor in capital, conditions had to be created which would make it possible to attract investment from abroad. Such were the basic reasons which led most countries possessing the natural resources required for industrial development to adopt protectionist policies. The economic doctrines of Friedrich List, which have helped the consolidation of Germany, now spread all over Europe and beyond it, with the only important exception of the United Kingdom which still feeling secure of its industrial and financial supremacy, was unshaken in its adherence to the principles of Free Trade. The United States, of which the industrial development required large importations of capital from abroad, had to create a sheltered position for foreign capital invested in American concerns. In Germany, Bismarck, after having created the Empire, sought to equip it with an economic machinery powerful enough to support the mighty structure of the State. Bismarck's tariff policy, followed by the contractual efforts of Caprivi, which provided a network of trade treaties favouring Germany's industrial expansion, completed the work of economic consolidation begun, half a century earlier by the Zollverein. France developed its protective system from the nineties onward. Russia, when, in the nineties, she entered upon a period of deliberate industrialization, under the leadership of Witte, by increasing its tariffs sought both to attract capital, which she lacked, from abroad, and to secure her young industries from foreign competition on the home market. With industrial expansion, began the growing struggle for colonial possessions, as sources of raw materials and as markets for manufactured goods. Political and economic nationalism began to make itself increasingly felt. Yet, this development of nationalism still proceeded within an expanding world market, and the system of world economy continue to function unimpeded. Tariffs, though they tended to increase, did not reach prohibitive heights. Trade treaties, although naturally inspired by national interests, served to extend the freedom of trade generally, since the most-favoured-nation clause usually found unconditional

application in contractual arrangements. Though in certain basic branches of production business combinations have made their appearance, and some attempts at international agreements between such combinations have been made, international trade and the whole economic life of the civilized world still obeyed the laws of competition. Any intervention of Governments aimed at influencing the course of international trade took the form of modifications in the tariffs. The tariffs, moreover, even in the most strongly protectionist countries, were still relatively so moderate that, on the whole, production and international trade could be continued on the normal basis of relative costs.

As in every other domain, the war changed the situation in this respect completely. The world market broke up from the beginning of hostilities, and such commerce as could be restored later had to be carried under entirely abnormal conditions. The commercial régime, with its network of trade treaties, tariffs and other international arrangements, collapsed at least in so far as the belligerent countries were concerned. The supply of foodstuffs, raw materials and other products, some of them required for consumption in unheard of quantities, had to be assured at all costs. Both their purchase and their utilization had to be strictly supervised and controlled, and programmes of supply had to be drawn up in advance and carried out as best one could. Government planning and control extended over every branch of economic activity, so much so that one could hardly conceive of the world, after the war was over, returning to competitive conditions. The experience of planned and controlled production and trade in the war had left deep traces in post-war developments, the more so that, in order to pass from Government control to competition with the minimum of difficulty and losses, demobilised industries have often sought to preserve a certain unity of control by joining forces in business combinations.

International trade, during the period of post-war demobilization, had also remained subject to serious restrictions, due to a variety of causes. Though the war-time planning and direct control of foreign trade in most countries was discontinued, a commercial régime was introduced in which a return to the pre-war competitive basis of commerce was impossible. The foreign trade of all the belligerent countries, in Europe at least, was entirely subordinated to the immediate needs of economic and financial reconstruction. It became part of the programme of restoring production and consumption to their normal condition. Accordingly, the commercial policy of particular countries varied enormously, and all kinds of restrictions were applied to both imports and exports.

Imports were restricted mostly on financial and monetary grounds, which were enormously increased in importance by the fact that the financial burdens of the belligerent countries, due to the war, had reached impossible proportions, and that inflation had utterly disorganised the monetary system. Exports were not infrequently either prohibited or restricted, with a view to avoiding scarcity on the home market; in other cases, the heavy depreciation of the national currency made such restrictions imperative to prevent the drain which the premium on exchange was likely to cause in the wealth and the income of the nations concerned.

Moreover, Europe issued from the War with new countries new national frontiers and fresh nationalisms which saw a guarantee of political sovereignty in the achievement of economic autarchy or independence. Commercial policy was, accordingly, made to serve the purposes of assuring to post-war States new and old, the essentials of economic self-sufficiency. Extreme nationalism, the utter subordination of foreign trade relations to the immediate needs of economic reconstruction and a severe disorganisation of all the mechanism of exchange were the outstanding characteristics of this period of post-war adjustment. During this period numerous commercial treaties and agreements were concluded, most of them for very short terms, with a view to establishing some provisional *modus vivendi* between the countries concerned pending the restoration of more normal conditions of international trade. Any consistent commercial policy, in the general state of disorganisation which prevailed, was impossible; trade languished and the sporadic revivals in it were mostly due to the freaks of inflation and the depreciation of currencies, which tended occasionally to favour the export trade of some country or other by enormous premia on exchange.

To revive international trade and to make possible the pursuit of any deliberate scheme of commercial policy, the mechanism of exchange had first to be restored.

This restoration took place during the period from 1923 to 1928, when, one after another, all the principal countries stabilized their currencies, thus removing the obstacles to international trade due to the absence of a stable monetary standard. As far as the monetary aspect of the problem of reviving international trade was concerned, the conditions of circulation of goods and of capital were much improved, and a powerful impetus to commerce was given. Indeed, for a time, even the extreme nationalism of the partisans of economic autarchy had apparently receded to the background, partly as a result of the difficulties already experienced in trying to put the idea of self-sufficiency into effect, partly because of the need urgently felt by all countries of extending their commercial relations with the rest of the world.

By the time when stabilization was completed, there was even a period during which it seemed as if, after years of aberration, the world would soon return once again to the orthodox canons of competitive economy, and that the world market would be restored. The World Economic Conference of 1927, which passed resolutions favouring the all-round lowering and the gradual removal of trade barriers and initiated a Convention to this effect, was an outward manifestation of the state of mind which prevailed then. For a time, indeed, the world seemed to enjoy a return to normal conditions of international trade, and there was even a certain lull in the imposition of new restrictions. But, with the exception of a few bilateral agreements providing for a reduction in tariffs on the basis of compensation, no actual lowering of trade barriers was effected; and the Convention for the abolition of prohibitions and restrictions on international trade, signed in 1928 by 29 countries, failed to secure the requisite number of ratifications and never became effective.

In fact, the apparent tendency towards the restoration of international trade relations on a competitive basis was largely superficial, and was mainly due to the impetus given to commerce by the stabilization of currencies and by the opening of large credits, as well as to the long-felt

need of re-equipment. Beneath this superficial current, which never involved more than a temporary cessation of further increases in trade barriers, there was a strong undertow of forces working in the opposite direction.

One of these forces, which came into play soon after the stabilization was completed, originated in the process of the restoration of stable rates of exchange. As some currencies had been stabilized at a level considerably above their purchasing power parities, while other currencies were relatively undervalued, stabilisation caused in many cases a serious rupture between the external value of currencies, as measured by their rates of exchange, and their internal value, as expressed in the level of prices on their respective home markets. Under such conditions, the maintenance of the rates of exchange in countries with over-valued currencies necessitated a manipulation of the trade balance involving a restriction of imports by tariffs and other measures. This was all the more imperative because other countries, possessing under-valued currencies, provided what was virtually a premium on their exports which benefited by the difference in exchange. Accordingly, while the stabilization of currencies eliminated some of the principal obstacles to the development of international trade, it was carried out in a manner which eventually led to the raising of new trade barriers. As the increase in the tariffs of some countries was bound to provoke retaliations on the part of others, the situation contained the seeds of a real tariff war of which the first signs appeared about the close of the period of stabilisation in 1928.

Another force, working for increased protection, which exercised a powerful influence upon the evolution of commercial policy in Europe during this period, was the development of agricultural production. Since the war, which had greatly reduced the output of the agricultural industry in most European countries, everywhere great efforts have been made with a view to restoring or even increasing agricultural production. In all European countries, financial considerations combined with the nationalist striving for economic autarchy in promoting this movement, with the result that, by 1925, European production of the staple agricultural commodities had been practically restored to the pre-war level. The restoration of European agriculture, followed by several seasons during which world cereal crops happened to be above the average, tended to create conditions of competition unfavorable to the European farmer. In countries which had to supplement their home production by imports of agricultural produce this necessitated the adoption of protective measures. Particularly important events in this sense were the re-imposition of import duties on agricultural products by Germany in the tariff of 1925, and the re-introduction of duties on imported wheat by Italy in the course of the same year, followed by the comprehensive scheme of agricultural development known as the Wheat Campaign. Both these steps taken by countries playing an important part on the world agricultural markets, by which they started a movement of active protection and encouragement of national agriculture, could not fail to exercise a strong influence upon both their respective home markets and the world market. The tendency towards agricultural protection, which had distinguished European commercial policy since the end of the war, now became particularly pronounced.

A characteristic feature of the commercial policy of the period of stabilization was the change which took place in the application of the most-favoured-nation clause.

In the development of the system of competitive world economy since the middle of the nineteenth century, the most-favoured-nation clause has played a particularly important part as an instrument of continuous expansion of international commerce. Although the principle of the most-favoured-nation treatment has been known and used since the close of the eighteenth century, when it came to displace the Mercantilist conception of pure reciprocity in international dealings, it was applied then in a conditional or limited form, known as the American most-favoured-nation clause. In this form, it constituted a limited extension of any preferences granted to third parties to the signatories of a commercial agreement on the conditions on which such advantages may be granted to their eventual beneficiaries. This stipulation, first embodied in the Franco-American Commercial Treaty of 1778, subsequently came into general use, until, in the sixties of the nineteenth century it was, in its turn, displayed by a device more consonant with the liberal tendencies of the time and better suited to the requirements of a world economy in the making. The unconditional most-favoured-nation clause was first introduced in the commercial treaty between the United Kingdom and France, negotiated by Cobden in 1860. By this, the contracting parties engaged themselves to extend to each other unconditionally any favour, preference or reduction in tariffs they would grant to a third party. This interpretation of the most-favoured-nation treatment was universally adopted in the late nineteenth and the early twentieth centuries and became an essential element in the system of competitive world economy. The United States alone had continued to use the so-called American or conditional most-favoured-nation clause, until in 1915, in a commercial treaty with the United Kingdom, she also adopted the unconditional form, to which she has since consistently kept in all subsequent dealings.

In spite of the growth of protectionist policies since the closing decades of the last century, the most-favoured-nation clause, in its unconditional form, still held the field firmly, exceptions to it being admitted in special cases only. Indeed, apart from certain standard cases of exemption, such as frontier traffic, customs unions or trade relations between a country and its colonies, such exceptions before the war were rare. The most important of these exceptions applying to trade between economically independent countries belonging to a political unit of super-national order, was the British Empire clause. This exception found application, before the war, to the preferential treatment accorded by Canada, New Zealand and Australia to the United Kingdom. The next step in the application of the exemption was made in 1919, when the United Kingdom granted preferences to the Dominions in respect of the MacKenna duties. Other examples of exceptions to the most-favoured-nation clause before the war referred to trade relations between the various South American Republics, to Central-American trade, to the trade between Cuba and the United States and to a few other local cases.

Since the war, and especially since the stabilization of currencies gave an impetus to international trade and produced increased activity in

the domain of commercial policy, far more serious and far-reaching limitations have been imposed upon the unconditional application of the most-favoured-nation clause. These limitations were partly due to the necessity of adaptation to changes which have taken place in the political frontiers; partly they resulted from the new nationalist outlook and from the desire, when national autarchy was impossible to achieve, to attain at least some degree of economic independence by means of regional economic co-operation between countries more or less naturally connected.

Thus there appeared a whole series of new, and sometimes very important, exceptions to the most-favoured-nation clause.

The Nordic clause provided for an exception in respect of trade relations between the three Scandinavian countries. The Border States clause exempted all trade between Estonia, Latvia and Lithuania; between Estonia and Finland and between all the Border States and Russia. The Russian clause provided for the trade between the U.S.S.R. and all the former parts of the Russian Empire as well as for trade relations between Russia and her Asiatic neighbours. The Osmanic clause exempted the trade between Turkey and the territories which had belonged to her before the war. The Bulgarian clause provides for an exemption in the case of any preferences granted by Bulgaria to Rumania, Yugoslavia, Greece and Turkey. The Iberian exception, originally applying to trade relations between Spain and Portugal, was later extended to the former colonial possessions of these countries in South America. The Japanese clause exempts preferences and facilitations granted by Japan to the U.S.S.R. and to China with a view to improving trade conditions between these three countries in the Far East.

It may be seen from the above that, even before the present depression, the limitations imposed on the application of the unconditional most-favoured-nation clause tended increasingly to impinge upon the unity of the world market by creating a system of regional preferences and thus isolating certain trade areas from the sphere of general competition. In the general tendency towards economic particularism, which gradually undermines the very foundations of competitive world economy, this reaction against the most-favoured-nation clause, as one of the most powerful means by which the fusion of national economies into a single world economy was assisted, was characteristic of the new orientation of commercial policy. This new orientation, of which the early development was outlined above, found a definite expression in the evolution of commercial policy since the beginning of the present depression in 1929, and became particularly accentuated after the financial crisis of 1931.

With the setting in of the economic depression in 1929, protectionist policies have received a fresh impetus. As the depression deepened and spread, new factors were brought into play. On the one hand, the pressure of competition on the world market, especially in the case of agricultural products, increased continually, with the result that, in order to protect national production, tariffs had to be raised. On the other hand, apart from the influence of foreign competition, the maladjustments responsible for the crisis were more or less seriously felt in every country. The structural changes in the economic system, to which the crisis was ultimately due, and which involved every aspect of economic life, have

affected all countries, though not all to the same extent. Accordingly, apart from the immediate task of setting up some system of defences to ward off the danger threatening the home market from without, serious attention had to be directed to the better organisation and co-ordination of economic activities within the country, with a view to restoring equilibrium. The two aspects of the problem could not be separated, since neither passive resistance to the pressure of foreign competition upon the home market by the setting-up of trade barriers could alone bring a satisfactory solution, without an elimination of the internal maladjustments in economic activities, nor was it possible to attempt a co-ordination of these activities without in some way isolating the national economic system from disturbing outside influences. Thus, the forces set in motion by the economic depression made for a combination of increased protection with national planning; and the commercial policy of the period since 1929 clearly reflected this tendency.

In the preceding chapter, dealing with the problems of planned economy, the difficulties involved in the transition to it from the competitive system were outlined, and it was pointed out that, both in theory and in practical application, it meets with strong opposition, and that in many quarters it is thought that the sooner this movement is reversed, and the competitive system restored, the better. As a result of the divergence of views on this subject, since the beginning of the depression there has always existed a characteristic struggle between those who sought, in the first instance, to restore the world market, as a condition of national prosperity and progress, and those who wanted, by national action, "to put their own house in order first", and only then to consider the restoration of international economic relations.

At the very beginning of the depression, in September 1929, the League of Nations, in face of growing trade barriers, initiated the movement for a two-or-three years' tariff truce, which should eventually become a permanent arrangement. The Conference, which met in February 1930 to discuss the possibilities of concerted action to this effect failed, however, to reach agreement. Other attempts to remove hindrances to international trade have similarly failed. Tariffs and trade restrictions increased continually, until in 1931 the outbreak of the financial crisis and the radical change in the commercial policy of the United Kingdom, following on the abandonment by it, as well as by numerous other countries, of the gold standard, have nearly completed the destruction of the competitive world market. The development of trade restrictions of all kinds—tariffs, import quotas, licensing systems, prohibitions, monopolies, control of dealings in foreign exchange etc.—which took place since, has been dealt with in our review of the agricultural situation for 1931-32 and there is no need to return to it here. Suffice it to say that, far from being reduced since then, the activity in devising and imposing fresh restrictions had actually increased, and the changes in the regulations governing the admission of imported goods to some countries were so frequent as to make adaptation to them on the part of importers nearly impossible. Particularly marked was this activity with regard to the trade in agricultural products, and owing to the inability of farming to adapt itself rapidly to changing market conditions, the uncertainty it caused was exceedingly injurious to the agricultural industry.

When looking at the development of commercial policy since the beginning of the present depression, along with the extension of national planning, one is reminded of the following words of Werner Sombart: "The forms in which future international economic relations will be conceived will be neither Free Trade nor the most-favoured-nation clause, but commercial treaties, customs unions, preferences, import quotas, and so on."

From what has been said above concerning the recent developments in the application of the most-favoured-nation clause and from the general trend of restrictions on international trade, this diagnosis would appear justified. Certain features of the recent evolution of commercial policy and of international trade relations are interesting in this connection as they seem to point the direction in which the present changes are leading the world.

For three years, since the beginning of the depression, the trend of commercial policy has been towards greater economic isolation; and since the economic situation in spite of increased protection and of the deliberate intervention of Governments and other organisations in business, with a view to securing equilibrium within closed national frontiers, continued to deteriorate, there appeared some tendency for the views favouring a return to competitive world economy to be gaining ground.

In July 1932, the Conference of Lausanne settled the problem of reparations and thus eliminated one of the principal causes of economic and financial uncertainty and depression. As a further step towards economic recovery, the Conference decided upon the convocation of an international monetary and economic conference the terms of reference for which is outlined in its resolutions.

The proposed conference, according to these terms of reference, was to deal with monetary and credit policy, exchange difficulties, prices, capital movements and the improvement of conditions of production and trade, with particular reference to tariffs, prohibitions and restrictions and to producers' agreements. The Conference was thus called upon to eliminate or, at least, to mitigate, as far as possible, the impediments with which the particularist policies of most countries threatened finally to destroy the world markets.

Thus, from the closing of the Lausanne Conference in July 1932 to the meeting in London, in June and July of 1933, of the Monetary and Economic Conference, one could observe an interesting dualism of international and national action in economic matters, the former striving to reverse the particularist movement set on foot by the depression, and the latter persisting wholly unconcerned in piling up fresh barriers against foreign competition.

The purpose of the movement leading to the Monetary and Economic Conference was well formulated in the Introduction to the Annotated Agenda prepared by the Commission of Experts in January 1933: "In the movement towards economic reconciliation, the Armistice was signed at Lausanne; the London Conference must draft the Treaty of Peace. Failure in this critical undertaking threatens a worldwide adoption of ideals of

national self-sufficiency, which cut unmistakably athwart the lines of economic development. Such a choice would shake the whole system of international finance to its foundations, standards of living would be lowered and the social system as we know it could hardly survive.

While the Lausanne Conference deliberated, the first practical step was attempted at achieving a reduction of trade barriers by an agreement with Belgium, the Netherlands and Luxemberg have negotiated at Ouchy for the gradual reduction of tariffs, and which was open to adhesion by other countries. But that Convention has so far failed to secure ratification owing to the strong opposition it met, mainly on the part of agricultural interests.

The general trend was rather towards national action, and since in no case entire national self-sufficiency could be achieved, there has definitely appeared a tendency towards the deliberate organisation of regional and other economic co-operation between countries more or less complementary to each other. It will be noted that, even before the present depression a tendency in this direction could be observed in the limitations which have been imposed in numerous cases upon the application of the most-favoured-nation clause. In the course of 1932-33 considerable progress was made in this direction: a progress which, if continued, may lead to the formation of new economic links and combinations between countries and to the restoration of international economic relations on a new basis.

The lead in this movement was taken by the United Kingdom in promoting, together with the other members of the British Commonwealth, the Ottawa Economic Conference which met in July and August of 1932.

The Conference, which resulted in the conclusion of twelve trade agreements either by the United Kingdom and one of the Dominions, or by some of the Dominions with each other, concerning the granting of mutual preferences, expressed its views of the scope and purpose of these agreements in the following resolution:

"The nations of the British Commonwealth having entered into certain Agreements with one another for the extension of mutual trade by means of reciprocal preferential tariffs, this Conference takes note of these Agreements and records its conviction:

"That by the lowering or removal of barriers among themselves provided for in these Agreements, the flow of trade between the various countries of the Empire will be facilitated, and that by the consequent increase of purchasing power of their peoples, the trade of the world will also be stimulated and increased;

"Further, that this Conference regards the conclusion of these Agreements as a step forward which should in the future lead to further progress in the same direction, and which will utilize protective duties to ensure that the resources and industries of the Empire are developed on sound economic lines."

The Ottawa Agreements, besides establishing preferences and involving in certain cases a raising of existing duties on goods imported from foreign countries, also resulted in the introduction into practice in the United Kingdom of the system of quantitative limitation of imports by means of fixed quotas. They led also to the necessity of revision of the

existing bases of trade relations between various parts of the British Empire and certain other countries, the existing commercial agreements with which had to be brought into line with the policy adopted at Ottawa. Here, again, the most-favoured-nation clause had in certain cases to be waived, in so far as preferences granted by one member of the British Commonwealth to another in implementing the Ottawa Agreements were concerned.

Following the Ottawa Agreements, which tended to consolidate the economic bonds between the constituent parts of the British Empire, while surrounding it with a barrier of tariffs, the United Kingdom, in 1933, concluded several commercial agreements with countries with which it had important economic relations. Such agreements were signed with Denmark, Germany, Argentina, Sweden and Norway and Iceland, and their principal characteristic was that they were based on the principle of quantitative determination of the volume of trade between the countries concerned by the establishment of import quotas mostly fixed as percentages of the total importation of the products in question. While consolidating the trade relations between the United Kingdom and the other countries concerned, most of which have always been vitally dependent on the British Market, these agreements limit the application of the most-favoured-nation clause, in so far as they provide for the extension to third parties of the preferences granted by the United Kingdom to the other contracting parties only on condition of reciprocity in the treatment of British goods.

The Ottawa Agreements and the subsequent contractual arrangements with certain countries which, with the only exception of Germany, have always belonged to the British sphere of economic influence, constitute a very significant change in the trend of British commercial policy. The United Kingdom which, more than any other country, has been responsible for the creation, the development and the control of the system of competitive world economy, and of which the prosperity came vitality to depend upon the regular functioning of the world market, has now been forced to seek a way out of the depression in developing and consolidating imperial and regional economic relations.

In the evolution of modern commercial policy this is, undoubtedly, the most significant single event, the more so that it falls clearly into line with certain other trends which have already been noted above.

Indeed, while, since the war, world economy had never regained the strength and cohesion it possessed before, a tendency towards regional consolidation and co-operation has, for some time, been very pronounced. The more the cohesion of world economy is loosened, the stronger this movement towards the creation of closer contractual economic links between countries complementary to each other is bound to become.

The system, developed along these lines, need not necessarily be rigid and exclusive, in the sense that it should prevent the continuance or even the extension of trade between the countries bound by special agreements and the rest of the world. All it implies is that, as far as the national economies of the countries which are parties to such agreements are complementary to each other, there would be preferential arrangements which would place the essential complementary branches of trade between them in a more advantageous position than the one they would find on other markets.

Whether or not this will prove to be the direction which the economic development of the future will actually take, it is too early to say. But the recent evolution of commercial policy would appear to point this way. Indeed though they have so far brought no positive results, the efforts of the countries of Central and Eastern Europe belonging to the so-called Agrarian Block, from the first beginnings of their economic co-operation in 1930, through the Stresa Conference to the recent proposals concerning their economic reconstruction and to the present attempts at an economic rapprochement between Czechoslovakia, Rumania and Yugoslavia, would appear to point in this direction. So do the preferential arrangements between Russia and her immediate neighbours in Europe and Asia, which are excluded from the operation of the most-favoured-nation clause; between Japan and Russia and China in the Far East; between the Scandinavian countries, and some others of lesser importance which either actually constitute steps in this direction, or provide for the possibility of such steps eventually being taken.

Modern commercial policy is in many respects characteristically different from the one more or less universally followed in the past, when world economy was in the process of expansion and consolidation. In many ways, it represents a reversion to mercantilism, which had prepared the ground for the eventual triumph of the modern competitive system. It would seem as if Mercantilism, which had nursed the early beginnings of competitive Capitalism, is again being called upon to nurse in its infancy the new system of planned economy.

As we have had occasion to point out elsewhere, modern commercial policy had been lent a distinctly Mercantilist colour by the financial legacy of the war, which had increased international debts out of all proportion and had placed the problem of the trade balance in the forefront of political pre-occupations. Moreover, the combination, especially since 1931, of high tariffs and trade restrictions with exchange control made triangular or indirect trade so difficult that it caused a reversion to the crudest form of Mercantilist doctrine which demanded a strict balance to be maintained in the trade relations of any two particular countries.

Particularly important, as part of the constructive efforts of modern commercial policy, is the return to favour of the old Mercantilist principle of strict reciprocity as basis of international trade relations.

In the scheme of international economic relations based on agreements between planned national economies complementary to each other the principle of reciprocity is, indeed, fundamental.

International trade must be fitted into the general scheme of planning and co-ordination of economic activities, and it cannot be so fitted unless the arrangements concerning the exchange of goods or services between the parties to an agreement are perfectly definite. This requirement is most effectively met by the adoption of quotas or other means of quantitative limitation, which have of late been coming into wide-spread use. Least satisfactory from this point of view is the unconditional most-favoured-nation clause, since, by opening widely the door to third parties, it precludes any possibility of effective co-ordination of imports with other economic activities, which is an essential part of planning. Accordingly,

the unconditional most-favoured-nation clause would appear to be losing ground, and the conditional form, discarded since the middle of the last century, to be increasingly used. Trade agreements, instead of providing for more or less general facilitations of trade between the countries concerned, tend, as a rule, increasingly to resemble business contracts which stipulate the exchange of certain concrete advantages, often determined quantitatively by the fixing of definite quotas. Here, the old Mercantilist identification of a contracting State with a trading merchant appears with particular clearness.

Looking back at this brief survey of the recent evolution of commercial policy, one is led to the conclusion that the failure of all the recent efforts aimed at the restoration of the world market by an elimination of trade barriers has not been accidental, but had causes deeply rooted in the process of economic transformation which has already been in progress for some time.

The structural changes which have taken place in world economy in the course of the last two decades, and which have been enormously accelerated by the war, have produced serious maladjustments in the economic system and have been mainly responsible for the present depression. This depression which has been felt continuously since the war and which entered into a critical stage in 1929, forced all countries to set up complicated systems of defence of their national markets and, at the same time, to attempt the planning and co-ordination of economic activities within their own frontiers. The world market was, thus, severely disorganised and largely put out of action by the rapid growth of trade barriers. Moreover, the world market, as we knew it before the war when it was an essential part of the competitive system, was hardly compatible in its purely competitive form, with an economic system in which the element of deliberate planning and control was continually gaining ground. Since, however, no amount of planning, however perfect in itself, can solve the problem of keeping national income and standards of life on a level which would permit the future maintenance of modern civilization and comfort, without international economic co-operation, the need for such co-operation is constantly felt, and efforts are being made to restore it either by a return to the old competitive world market, or by building up a system of world economy on a new basis.

The first of these alternative solutions has been tried repeatedly, and has repeatedly failed. The World Economic Conference of 1927; the discussions on the "tariff truce" in 1929 and 1930; and finally, the Monetary and Economic Conference of 1933, have all proved unable to reverse the trend of evolution of modern commercial policy. Indeed, in the course of that evolution, while all countries have been trying to protect national producers and to mitigate the effects of the depression, too many vital interests and too important groups of population have become identified with the maintenance of the present measures of protection and of national planning to permit their removal. All countries, even though they may realise the extreme importance of restoring international economic co-operation, are naturally disinclined to sacrifice important groups of national producers. Throughout the Continent of Europe, the immediate effects of a removal of the measures of agricultural protection on the peasants alone is a strong enough reason for Governments to refuse any serious move in this direction.

The result is that, though, at all international meetings, the necessity of restoring international economic co-operation is unanimously recognised, when it comes to the discussion of concrete measures to this effect, involving the abolition or reduction of trade barriers, agreement becomes impossible, and all attempts at restoring the world market invariably fail.

The second alternative, which implies the re-establishment of international economic relations and the re-integration of world economy on a new basis, would appear, on the other hand, to be imposed by the trend itself of modern economic development. In their struggle for the maintenance of their standards of economic civilization and general welfare, all countries are driven to seek ways and means of international co-operation, in forms which would suit the trend of evolution of their national economic policies. Sometimes by devious ways, without a return to the old machinery of a competitive world market, through a network of trade agreements between national economies complementary to each other, life itself is forcing the separate economic units to co-operate and to weld the world once again into a vast economic whole. In this new world economy, which would appear now to be in the making, the cohesion between the constituent planned national economies would be assured not by competition, but by fixed contractual arrangements, which would bind the various parts together no less closely and securely than they used to be bound in the past, under the old competitive system. The process of re-construction of world economy on this new basis, which is the only one suited to the conditions imposed by the development of national planning, is bound unavoidably to take time and to involve considerable friction; but unless we misread its symptoms, the present trend of evolution of commercial policy points to the re-integration of world economy on these lines.

(*To be continued.*)

THE BALANCE SHEET OF ENTOMOLOGY*

AS pointed out some years ago by a distinguished president of the American Association for the Advancement of Science, there must be, previous to the annual convention of every scientific society, one man who spends months worrying over the subject for an address and its mode of presentation—and this in spite of the fact that no one ever reads a presidential address except the man who prepares it. Not only is this true, but if any one ever did take the trouble to read through the presidential addresses given before any society that has existed as long as our own, he would find that everything had been said that could be said, or, at least everything that custom decrees as suitable for such occasions. Though differing in subject, treatment, and point of view, they resemble each other in expressing ideas with which we can all agree.

Every year we come together to exchange ideas, to record achievement and to rejoice in the progress we have made. In studying the addresses of my predecessors, there appears, however, to be one element that, at least, has not been over-emphasized, namely, the element of self criticism. Accordingly, the thought occurred to me that, in attempting an evaluation of the present status of entomological science, a little more stress might, with advantage, be placed upon our shortcomings and upon our failures to achieve what we might have accomplished, had the fullest use been made of the opportunities presented. The present speaker is well aware of his lack of qualifications to perform such a task, but hopes that the mere attempt may be of value in provoking thought and preferably some disagreement, from which constructive discussion may be expected to arise.

Looking back over the past twenty-five years, which is a most significant period in the history of our science, it is easier to observe the positive achievements than the failures. At the beginning of that time the first established branch of entomology, viz., taxonomy, was already old and had many splendid achievements to its credit, along with much work that had better not been done. When a few more able men with sound fundamental training in morphology, together with a few skilled biologists, geneticists and mathematicians escape into the rich field of taxonomy their methods may have a fertilizing effect upon the sometimes sterile science and perhaps a greater amount of concern may develop to ensure that species are biologically as well as bibliographically accurate. We hope it is not too much to expect, also, that a larger proportion of our taxonomists may pause in their compassing of land and water in order to discover new species, to prepare those careful revisions of a genus, family or order, preferably one of the members of which may conceivably have some economic importance, of which we have all too few.

* By W. H. Brittain, Macdonald College, Quebec in *Sixty-Third Annual Report of the Entomological Society of Ontario,* Ontario Department of Agriculture, 1932.

At the opening of the period indicated we already had a number of classical papers in the field of morphology that have scarcely been surpassed and, when we consider such excellent sustained contributions as those of Snodgrass and the fundamental studies of our own Dr. E. M. Walker, we can only hope that their tribe may increase faster than the new nomenclature that certain others delight to create.

In insect biology, in its widest sense, we owe a great debt to a generation of inimitable observers who have all but passed away. Modern workers, with a new viewpoint, new concepts, new apparatus and new discoveries in sister sciences to aid them, are fast accumulating a mass of accurate experimental data that, in many cases, is not only supplying new facts, but giving us a new and better conception of fundamental principles underlying our science. One has only to read the presidential address of the late Dr. C. Gordon Hewitt, which dealt with insect physiology, before the American Association of Economic Entomologists in 1918, to realise what progress has been made even in that brief period, and no one who has observed the present trend can doubt that work in this field will proceed with increasing acceleration. It is to be hoped, however, that in the modern pre-occupation with experiments, in reliance upon apparatus and upon mathematical methods, we do not lose entirely that element that gave to the work of the older generation of naturalists its peculiar value.

In no way can the progress in entomology be more clearly observed than in the numerous well aranged, well written and well illustrated bulletins, that make so many of those of former years appear crude and unfinsihed. This is true of all entomological literature, but particularly to that relating to the economic phase of the subject. No one will pretend, however, that there is no need for further improvement in matters of form as well as in subject matter. It is a great pity that we cannot have more technical publications of a monographic character. We know of workers spending years upon a study in which countless difficulties have been encountered and overcome, and at the end the results are published in a six-page pamphlet. The data on which conclusions are based and the technique used, so important from the standpoint of the worker in the field and so essential for the progress of the science, are not mentioned.

Those who have much bibliographical work to do, as all research workers must have, find the multiplicity of series into which publications are classified a continual source of trouble and annoyance. We have research bulletins, press bulletins, technical bulletins, special bulletins, popular bulletins, extension bulletins, old and new series, circulars, special circulars, miscellaneous circulars, pamphlets, leaflets and what not in endless confusion, causing a constant rock of offence to the bibliographer, the filing clerk and the librarian. Surely all these categories are unnecessary. The taxonomic distinction between a circular and a pamphlet for example is difficult to discern.

Twenty five years ago there were no separate departments of entomology in our colleges and universities and at only two institutions had it attained the dignity of a separate subject. Not more than ten years ago the Dean of a graduate school at a great Canadian University remarked

to an applicant that surely he did not propose to spend his whole lifetime on such a trivial and narrow subject. A recent presidential address has outlined our progress in this field and further repetition is unnecessary.

Probably no one who is engaged in the teaching profession would look upon the present situation with any degree of complacency and all recognise the necessity of higher standards, sounder and longer training and improved equipment to keep pace with recent advances and discoveries. The present tendency is for a sounder background in the physical mathematical and biological sciences and for the postponement of specialised training. There is recognition of the fact that for professional requirements the university course is not sufficient and that there is no substitute for laboratory and field experience in a student's training.

The instructor today who encourages a student to enter entomology as a life-work is incurring a grave responsibility. We must have a more careful selection of the human material, a better trained product and a drastic cutting down in numbers. It may be that we should train more entomologists as some have contended. Those of us who have to do with students, however, know that during the last two years there have emerged from our universities a larger proportion of able young men incomparably better trained for their life-work than those entering the field a generation ago, and that many of these have been forced to take non-entomological positions or have joined the great army of the unemployed. It seems to the present speaker that, for a long time to come, we must endeavour to follow also the line indicated rather than to strive for mere numbers.

Employers, however, should not indulge in unreasonable requirements. To expect finished products of two or three year students or even of graduates is asking too much. We constantly see advertised positions demanding the most highly specialised training in a certain narrow field and we often hear public men complaining that they have had to go to some other country to get the man with the specialized experience necessary and perhaps blaming the universities for not providing such men. Does not this reveal a defect in our methods of securing men? Perhaps the position referred to is the only one of its kind in the country. It might be necessary to train a score of men in order to select one capable of performing the task. Would it not be better to select a man with the native ability and bent for that kind of work, together with the basic fundamental training upon which to base specialization in that particular field. Such a man should very soon succeed in outdistancing one of lesser ability chosen because he chanced to have the particular specialized experience desired. If we also had a more flexible system that would allow men to develop problems and then to create positions for them, we would be more closely approaching the ideal.

From the standpoint of organisation our progress has been so marked as to require little comment. The first official Provincial Entomologist was appointed in 1912 and a Dominion Entomologist only two years earlier. The highly developed organisation we have today carries with it certain dangers, the greatest of which is in over-departmentalization. The present trend is for grouping workers around a problem rather than around a subject. Fortunately there are signs that this idea is taking hold and it cannot be too strongly encouraged.

At the beginning of the period to which I have referred, we had, in economic entomology, scarcely emerged from the salt, wood-ashes and "pull up and burn" era. The impressive developments in chemical control were only beginning, while the utilization of the biological control method, of bioclimatic data in connection with economic outbreaks and distribution, the application of knowledge based on sense reactions and the whole technique of experimentation, is still in a state of rapid evolution. With all our progress there is still need for greater use of the discoveries made in other sciences, for the more general adoption of refinements in experimental technique in the working out of new methods. One does not have to make a fetish of the methods of mathematical analysis to observe that many entomological papers are often positively infantile in their disregard of what constitutes scientific evidence. In this respect we have fallen far behind the workers in other fields upon whom we used to look down as from a great height.

The past decade has shown a great expansion of so-called "plant-quarantine" organizations often overshadowing other services. Some legislation of this character that has been passed by national or local legislatures may have been wise, more has been futile and some vicious. There is more than a suspicion in some cases that such legislation has been seized upon as a weapon in the war of economic nationalism that is now sweeping the world. Those who have fostered this sort of thing have much to answer for. Whether the vast sums that have been expended on many of these projects might not, in many cases, have been put to a use that might have resulted in discoveries of basic significance and permanent value, is a thought that we cannot escape.

Dr. L. O. Howard once said that all entomology is economic and the late Dr. S. A. Forbes remarked that the economic entomologist is an ecologist whether he realizes it or not, working in that border land where the ecology of man and the insect is coincident. Carrying this thought a step further we may say that any science that can be utilized in the control of insects is within the province of the economic entomologist.

Strange as it may seem, our most conspicuous success seems to have been in the field of extension work. Still regarded as a harmless nuisance a few years ago, the economic entomologist has now reached a place where he no longer has to apologize for his existence. Such organizations as "Spray Services" are known and valued by those who used them. It is doubtful if those departments who formerly regarded themselves as exclusively entitled to the adjective "practical" can show a like record.

I do not refer to the foregoing fact for purposes of congratulation, because I fear that our happy position in this field is jeopardized by much that is said and done in the name of "publicity", but which might better be termed propaganda. Publicity by the right sort may be allowable: it may even be necessary, but our own system of government does not practically force that sort of thing upon public servants as it does in certain other countries; neither is it necessary to indulge in gross exaggeration in order to scare the public into according the support for a needed appropriation. One constantly sees definite figures quoted of insect damage, based on the flimsiest of data and figures claiming enormous financial savings as a result of the efforts of certain individuals or organizations.

It should be realised that this sort of thing undermines the scientific judgment and worse still the scientific integrity of those making such claims, so that, in the end, they come actually to believe the accuracy of their own "estimates". Since the great war it has become the diversion even of eminent scientists, together with a host of lesser imitators, to draw, in apocalyptic language, vivid pictures of what the poor old world is coming to as a result of the insect menace, in line with the motif employed with such telling effect by Maeterlinck in the famous passage in which he describes insects as our "rivals in these later hours and perhaps our successors." Aside from the aesthetic pleasure derived from such glowing periods, I confess that they effect me somewhat differently than they appear to do some other readers. Being perhaps of an essentially irreverent disposition, being sometimes "moved to unseemly merriment where wiser men are impressed", it only calls to my mind a nursery rhyme that I learned long ago about a certain "little orphan Annie" and the stories she told of "goblins that will git you if you don't watch out".

Even though it may be as the voice of one crying in the wilderness, it seems necessary to point out that this type of exaggeration is likely to lose us that measure of public confidence we now enjoy and to express the thought that it is better to say what is true rather than what is merely striking, to understate rather than overstate and to make no claims at all that cannot be justified on the basis of sure fact, weighed, tested and approved.

If, however, entomology has not registered its maximum potential achievement during the past quarter of a century, the fault cannot be laid in its entirety at the door of the entomologists. Much has been due to the failure of those in authority to realize the needs of the situation. No one has ever suggested, for example that the agronomists, the horticulturists, the animal husbandmen or geneticists should get along without living plants or animals to work with, and all the paraphernalia of caring for them. In a good many years experience with fruit and vegetable growers, I have never encountered any difficulty in securing all the land required for commercial tests. But is the same attitude shown by those in control of affairs at our experiment stations or agricultural colleges? It is not, and until the necessity of the entomologists and their colleagues the plant pathologists of having under their own control land, plants and equipment, without having metaphorically to go down on their knees for them is recognized, we can never hope to accomplish our greatest usefulness.

Those who ten years ago, thought that they saw entomological work assuming a dead level, have seen their fears proved groundless. Those who thought that they saw us coming to the end of the problems that confronted us have seen new fields of usefulness and new methods of research constantly opening up. Today there are countless problems vitally affecting the health, wealth and welfare of vast populations in all parts of the earth awaiting attention. The thought that I would like to emphasize in closing is that these problems can only be solved by those specially fitted by ability, temperament and training to do so.

PASTURE REQUIREMENTS AND COMPOSITION*

THE wealth of the Australian Commonwealth is largely derived from primary products, and particularly is this the case in the State of Queensland. These primary products are dependent on pasture growth; in fact it has been stated that more than three-quarters of the monetary value of Queensland's exports is derived from grasslands.

From this it will be seen how important it is that all information obtainable regarding pastures should be utilised in order that greater production of all primary products be attained, and that at the lowest cost.

That extensive research work is required in connection with the pastures of Queenland is well known, but mention should be made that information of economic value regarding some of these pastures has been obtained and widely published and that, although some have made use of such information in their pasture management many owners of similar pasture have not. This matter will be referred later.

That some attention was paid to pasture in early times will be seen from the following interesting extract taken from an article—"The History of Pasture Analysis", by William Davies.

> "Worlidge in his "Systema Agriculturae: the Mystery Husbandry" (1687) considers at some length the management of pastures and refers to the sowing of ray grass (=perennial rye grass), St. Foyn (Sainfoin) and la lucerne (=lucerne) for the purpose of providing hay and fodder. He makes no reference whatever to specific examination of the resultant herbage crop. Similarly, Marshall (1788) refers to methods for improving grasslands, but makes no suggestion relative to herbage analysis. Sinclair (1824) provides valuable information regarding the leading grassland outlook of his day. His own work, together with that carried out in collaboration with Sir Humphry Davy, lays the foundation for combined agronomic and chemical studies on individual British grasses and clovers."

From this it is seen that pasture has been studied from early times, but from about the beginning of this century what may be termed a special detailed pasture investigational period has occurred, and that such pasture study has been world wide, covering humid to arid climatic conditions.

During the later period mentioned there have been, no doubt a number of reasons for the particular interest taken in grass study, but the main reasons, it is considered, have been the importance of making practical

* By E. H. Gurney, Agricultural Chemist in *Queensland Agricultural Journal*, Vol. XLI, Pt. 3, 1 March, 1934.

use of the fact that great variation in composition of grass occurs at different stages of growth, and that when the feed-value of grass is being considered the amount and composition of its mineral content has also to be taken into very definite account.

Before describing the variation in composition of some of our grasses, brief mention may be made of the functions of some of the food ingredients *e.g.*, proteins, fibre, and mineral matter contained in grasses and other feeding stuffs.

Proteins are complex nitrogenous bodies existing in grasses and foodstuffs, and are used by animals for building up the proteins contained in the muscle, flesh, and blood of their bodies. For the purpose of making flesh, etc., the young growing animal will require a relatively large amount of protein in its feed whilst the mature animal requires the protein for repairing waste in the body, and particularly is an extra supply of protein required by an animal producing milk.

Some quantity of fibre in foodstuffs is useful in giving bulk to the food and in aiding to a certain extent digestion. Different animals require different amounts of fibre in their rations. The digestion and evacuation of fibre necessitates the use of some energy by the animal, therefore the extent to which fibre in any foodstuff is digestible is of importance.

Mineral matter is required by the animal for bone formation in maintaining the normal condition of blood and other body fluids, and particularly in mineral matter required by animals producing milk.

The more recent work upon grass and grassland has shown that malnutrition of stock is caused, in many cases, by insufficient or improperly balanced mineral matter in the grass feed, and that even when distinct evidence of malnutrition is not apparent that low production or ill-health may be caused by some mineral deficiency.

	Water free Material				Remarks
	Crude Protein	Crude Fibre	Lime	Phosphoric Acid	
Paspalum	20·6	23·7	·41	·61	Short young grass
Ditto	5·7	35·2	·54	·33	Old stemmy growth
Rhodes grass	16·4	27·1	1·19	·72	Young leafy grass
Ditto	5·8	33·3	·58	·60	Old stemmy growth
Mitchell grass	17·1	30·9	1·0	·53	Young
Ditto	8·76	39·7	·56	·49	Midgrowth
Ditto	4·02	43·4	·46	·24	Mature
White clover	29·9	16·9	1·56	1·18	Young leafy growth
Ditto	18·1	22·1	2·07	·52	Old growth
Lucerne	29·4	17·0	1·97	1·01	Young pre-flowering growth
Ditto	18·4	32·6	3·54	·67	Old mature growth
Phalaris tuberosa	25·9	19·6	·50	·34	Short young grass
Ditto	10·8	27·7	·81	1·13	

A few examples showing the difference in composition of plants at different stages of their growth are given above, but it must be understood distinctly that all the figures quoted are calculated upon the analyses of "water-free material" contained in the plants.

These figures are not the extreme limits of variation in composition that may occur in plant growth, for in the very young growth of a number of forage plants a protein content of 33 per cent. and more occurs, whereas, on the other hand, in old matured growth, such as grass roughage, the crude protein content may be about 1 per cent. together with less than one-tenth of 1 per cent. of phosphoric acid.

That young pasture growth has a very high feed value and is in a digestible condition has been stated in many publications, but it is considered that this fact has not had the practical recognition in Queensland that its value deserves.

In our climate, owing to most of the seasonal rain falling during the the warmer months of the year, a very prolific and rapid growth of grass occurs. A very large proportion of this flush growth in the younger and highly nutritious stage is not consumed by stock, but continues to grow to maturity and ultimately becomes roughage of more or less low feed value. Thus it is that a large amount of highly nutritious foodstuff is not made use of, and it is important that serious consideration should be given by all stock owners to methods for the economical use of such valuable foodstuff. Suitable methods for the utilisation of young paspalum growth have been established and put into practical use with success by at least some owners of dairy stock in Queensland.

It has been demonstrated that after mowing and removal of roughage followed by treatment with suitable "renovators" even old established paspalum pasture will give heavy yields of fresh young growth when fertilized with 1 cwt. of ammonium sulphate and 2 cwt. of superphosphate per acre. This young growth may be utilised by a system of "rotational grazing," or by repeated mowings harvested, and conserved as hay or ensilage.

The fertilising of grass and feeding-off in the young stages of growth is of particular value when the soil is deficient in phosphoric acid, and a large number of our coastal soils have a poor phosphoric acid content. The fertilizing of these pastures also induces increased clover growth which, as mentioned before when young has a very high lime and phosphoric acid content.

The best results from all grass varieties may not be obtained by a method of repeated mowings or intensive grazing. Experiments with Rhodes grass dealing with this matter are being conducted.

In the case of Mitchell and Flinders grass, the making of hay with these grasses, when not too matured, would appear to be the most suitable method for the conservation of a certain amount of flush growth. Very fine samples of sweet smelling Mitchell and Flinders grass hays have been analysed and found to contain relatively high amounts of protein and low fibre.

From what has been said it is apparent that young grass growth is material of high feed value, and as it is produced upon the farm or holding it is cheaper than bought foodstuff of equal food value, and failure to make the most use of it means loss of profit.

Mention has not been made in connection with some different methods of pasture improvement, such as the introduction of the best grass strains and legumes into some of our grasslands, but it is generally recognised that such improvements would be of very great economic value.

Reference has mostly been made to the high food value of young grass growth, but it is considered that some stock owners place too much reliance upon the feeding of old matured grass. It should be fully recognised that this dependence upon old grass will result in lower production by all kinds of stock, particularly in the case of introduced high-grade stock, and in many cases through malnutrition will cause the stock to become liable to disease.

REVIEWS

"The Vegetable Products of Ceylon," (A Guide to Their Identification and Economic Uses) *by Frederick Lewis, F. L. S.—The Associated Newspapers of Ceylon, Limited, 1934. Price Rs. 10.*

THE title of this book is not quite so apt as it might be. It is a companion handbook to the Flora of Ceylon for the student interested more especially in the economic uses of our plants. It is a valuable book, a readable original volume, such as those who knew the author would expect from his vast accumulated store of knowledge gathered firsthand from the jungle itself. Its great beauty is its originality. Its source is nature but the author at the same time does not hesitate to quote the views of others whose works were his companions in compiling these notes. Notes on the useful flowering plants of Ceylon go to make up the book. Although the notes are arranged under the natural orders of plants the book does not profess to contain all the representative genera and species of each but chiefly those of economic import. The orders of plants are arranged as by Trimen in his Flora of Ceylon each being indicated by a Roman numeral, one would wish however in using the index that these had been indicated by the page rather than by this numeral. To be shown for instance in the index, Ebenaceae LXXX, is somewhat tantalising when we find that it is somewhere in the midst of twenty-six pages that lie between the preceding and following orders. The paging of the volume is for little purpose as the species are all indicated by their own number and not by the page.

The book is one that can be strongly recommended to the student of the economic botany of this Island as a companion volume to Trimen's Flora. It is well printed and altogether a well presented volume.

"Nature Teaching Based upon the General Principles of Agriculture for the Use of Schools" *by Sir Francis Watts. Published on behalf of The Imperial College of Tropical Agriculture. The West India Committee, 14, Trinity Square, London E.C.3. Price 3/6 net.*

The preface states the book should not be placed in the hands of any but older pupils who have already received oral instruction in the subjects dealt with and that it is primarily intended for the guidance and information of the elementary and secondary school teachers. This is a wise warning.

Unless a would-be teacher is himself a naturalist with at least a first hand knowledge of the elements of the sciences governing plant and animal life it is doubtful if he can ever kindle much enthusiasm for nature in others. No book on this teaching will by itself enable it to be done.

Failure to recognise this principle in many subjects has at various times been a mistake in colonial educational systems.

A compendium of materials for use in nature teaching is valuable and so far as this book supplies this it serves a useful purpose. We have looked for the note on Mendelism, said in the preface to be present, but neither the table of contents nor the index afford any help to locate it.

The book is presumably primarily written for the use of West Indian Schools. It is neatly got up and well printed.

MEETINGS, CONFERENCES, ETC.

COCONUT RESEARCH SCHEME (CEYLON)

BOARD OF MANAGEMENT

Minutes of the twenty-third meeting of the Board of Management, Coconut Research Scheme, held in Room No. 202, New Secretariat, Colombo on March 16, 1934, at 11.15 a.m.

Present:—Dr. W. Youngman, Director of Agriculture, (in the Chair), Messrs. C. H. Collins, C.C.S., Treasury Representative, Austin Ekanayake, A. B. Gomes, E. F. Kannangara, J. L. Kotalawala, M.S.C., G. Panditte-sekera, J.P., U.P.M., A. W. Warburton-Gray, J.P., U.P.M. and Dr. R. Child, Chief Technical Officer, who acted as Secretary.

Apology for absence was received from Mr. F. A. Obeyesekere.

MINUTES

The minutes of the twenty-second meeting of the Board of Manage-ment held on October 20th, 1933, were confirmed.

BOARD OF MANAGEMENT

The following changes in the Board of Management were reported by the Chairman:

Mr. Warburton-Gray on his return from leave resumed his place on the Board, relieving Mr. F. J. Holloway, J.P., U.P.M., who had been acting for him.

Mr. Fergusson had resigned his seat on the Board as he was not returning to Ceylon. Mr. A. Ekanayake had been nominated by the Planters' Association to serve on the Board from February 7, 1934. He thus relieved Mr. E. L. Spencer-Schrader who had been acting for Mr. Fergusson.

The Chairman welcomed Mr. Ekanayake to the Board and moved that the thanks of the Board to Mr. Fergusson for his services since 1929 be recorded; also to Mr. Holloway and Mr. Spencer-Schrader for their services whilst they acted on the Board. The Board approved the motion.

Financial Secretary's Representative.—The Chairman reported that Mr. C. W Bickmore, C.C.S. was leaving the Island shortly and that Mr. C. H. Collins, C.C.S. would act on the Board as the representative of the Financial Secretary in terms of Section 3 (1) (a) of Ordinance No. 29 of 1928. He welcomed Mr. Collins to the Board and moved that the Board record their thanks to Mr. Bickmore for his services. This was approved.

ANNUAL REPORTS

(a) *The Annual Report of the Board of Management*—in terms of Section 8 (2) of Ordinance No. 29 of 1928 had been circulated to members before submission to the State Council. The formal approval by the Board of this report was recorded.

(b) *The Reports of the Technical Officers for 1933*—were approved. It was resolved that the Annual Report should be published by the Scheme in full including the Technical Officers' Reports. In addition it was decided to publish a *Quarterly Bulletin*.

Visitors' Day at Bandirippuwa.—Arising out of the technical reports the proposal put forward by Mr. G. Panditteseker was discussed, that a definite Visitors' Day should be fixed when those interested could consult the technical officers. The Board decided to approve the principle of a monthly Visitors' Day and left it to the Chief Technical Officer to fix a suitable day in consultation with the Chilaw and Kurunegala Planters' Associations.

It was also decided to hold the next meeting of the Board at the Research Station.

(c) *Report of the Auditor-General for 1933.*—In connection with this report it was pointed out by the Chairman that against an apparently large cash reserve had to be set the Rs. 90,000 due on the Government Loan.

Passage Fund.—With regard to paragraph 11, page 2, of the Auditor's Report, it was decided to review the position regarding the Passage Fund, when the Estimates came up for discussion in October.

Cash Reserve for Depreciation.—The Board approved of the transfer of Rs. 13,870·36 to cash reserve for depreciation according to paragraph 14, page 3 of the Report.

The Report of the Auditor-General for 1933 was accepted.

ELECTRIC POWER PLANT

Accumulators.—It was decided to fit accumulators to the main and secondary power houses.

DEPARTMENTAL NOTES

ANTHRACNOSE—A FRUIT DISEASE OF CHILLIES

MALCOLM PARK, A.R.C.S.,

GOVERNMENT MYCOLOGIST

ANTHRACNOSE, a disease of chilli fruits, is of wide distribution, occurring almost everywhere chillies are grown commercially. It is recorded to be common in India, Burma and the United States of America, and has been found in all chilli-growing districts in Ceylon.

SYMPTOMS OF THE DISEASE

The symptoms of chilli anthracnose are best marked on the fruit. At any time after the latter is half grown, discoloured patches appear on one side or on the tip. At first, while the fruit is still green, the discoloured areas are brownish or olive green in colour and sodden in appearance and extend about half the length of the capsule along one side. There is often a premature reddening of the fruit round the discoloured area. Sometimes the discoloration extends to involve the whole capsule while at other times the disease is confined either to one side or to the tip. The discoloured tissue dries and assumes a light brown or grey colour and the skin becomes papery and wrinkled. When the spots are of limited size the diseased area is sunken below the level of the surrounding healthy tissue. The illustration shows fruits in different stages of the disease.

When the disease occurs near the stalk end, and when the whole fruit is affected, it may spread to the stalk which turns brown shrivels and the fruits thus attacked fall to the ground and rot. If the stalk is not involved, the fruits remain on the plant and become shrivelled and dry. Such chillies are useless for sale and the damage caused by the disease may result in considerable loss of crop.

All varieties of chillies are reported to be susceptible to the disease although, in one instance, a green vegetable variety was not affected whereas a curry variety grown on the same land at the same time suffered. This, however, may have been due to the early picking of the green variety.

CAUSE OF THE DISEASE

On the dried-up diseased fruits there can be seen a large number of minute dark spots, at first brown in colour and becoming black with age. These small raised points are often arranged concentrically and are the fruiting bodies of the fungus which causes the disease. The fungus has been named *Colletotrichum nigrum* and is one of a common group of fungi which cause spotting of, among other things, beans, mangoes, pomegranates and citrus fruits. Each minute body contains a large number of spores or seeds of the fungus and each of these spores is capable of causing the disease on a healthy chilli. The spores escape in the presence of moisture, either rain or dew, and, since they are so minute and so light, may

Anthracnose of Chillies

Fruits in different stages of the disease

be scattered for considerable distances, chief amongst which is wind. The disease is most severe in wet weather since such weather favours the growth and rapid spread of the fungus.

CONTROL OF THE DISEASE

It is stated above that the minute black points which appear on the dried up diseased fruits contain a very great number of spores which can be carried by the wind to cause the disease on other healthy chillies. That being so, it is obvious that when the disease appears, every endeavour should be made to prevent its spread by picking and destroying all diseased chillies, if possible while the disease is in its early stages and before the fungus gets a chance to produce its fruit bodies. The disease can be kept in check if the plants are carefully examined each day and every chilli showing signs of disease is picked and burned.

If the number of diseased chillies becomes great then it will be necessary to spray the plants. Spraying should be done once a week during wet weather when the disease is active.

The solution to be used is one containing some copper compound (that known as Bordeaux Mixture is suitable). For full information on this subject and help consult your nearest Agricultural Instructor.

There is a possibility that certain varieties of chillies may not be affected at all or only to a slight extent by this disease. So far, no truly resistant variety has been found anywhere in the world but the possibility should be borne in mind. If a grower finds that some of his chillies are resistant to the disease he should preserve the fruits of those plants for seed purposes.

Clean cultivation and regular rotation of crops will assist in keeping the disease in check.

Control measures may be summarised thus:—

1. Pick and burn diseased chillies each day.
2. If the number of diseased chillies is great, spray the plants once a week during wet weather.
3. Search for immune varieties.
4. Practise clean cultivation and do not grow chillies on the same land year after year.

ANIMAL DISEASE RETURN FOR THE MONTH ENDED 30 APRIL, 1934

Province, &c.	Disease	No. of Cases up to Date since Jan. 1st 1933	Fresh Cases	Recoveries	Deaths	Balance Ill	No. Shot
Western	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	44	15	30	...	14	...
	Anthrax	...	...	...	...	...	...
	Rabies (Dogs)	5	...	...	...	...	5
	Piroplasmosis	...	...	...	...	...	...
Colombo Municipality	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	294	291	111	6	177	...
	Anthrax	3	1	...	3	...	...
	Rabies (Dogs)	2	...	...	...	...	2
	Haemorrhagic Septicaemia	...	...	...	...	...	...
	Black Quarter	...	...	...	...	...	...
	Bovine Tuberculosis	...	...	...	...	...	...
Cattle Quarantine Station	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	11	...	9	1	1	...
	Anthrax (Sheep & Goats)	52	15	...	52	...	...
Central	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	...	...	...	...	...	...
	Anthrax	...	...	...	...	...	...
	Bovine Tuberculosis	3	3	...	...	3	...
	Rabies (Dogs)	...	...	...	...	...	...
Southern	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	141	20	141	...	...	...
	Anthrax	...	...	...	...	...	...
	Rabies (Dogs)	...	...	...	...	...	...
Northern	Rinderpest	140	90	34	91	7	8
	Foot-and-mouth disease	28	28	28	...	...	...
	Anthrax	...	...	...	...	...	...
	Black Quarter	...	...	...	...	...	...
	Rabies (Dogs)	...	...	...	...	...	...
Eastern	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	22	...	22	...	...	...
	Anthrax	...	...	...	...	...	...
North-Western	Rinderpest Foot-and-mouth disease Anthrax Pleuro-Pneumonia (Goats) Rabies (Dogs)	FREE					
North-Central	Rinderpest	50	38	8	32	4	6
	Foot-and-mouth disease	...	...	...	...	...	...
	Anthrax	...	...	...	...	...	...
Uva	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	132	...	131	1	...	...
	Anthrax	...	...	...	...	...	...
	Bovine Tuberculosis	...	...	...	...	...	...
Sabaragamuwa	Rinderpest	...	...	...	...	...	...
	Foot-and-mouth disease	233	37	205	...	28	...
	Anthrax	...	...	...	...	...	...
	Piroplasmosis	...	...	...	...	...	...
	Haemorrhagic Septicaemia	12	1	...	12	...	...
	Rabies (Dogs)	4	1	...	...	...	4

G. V. S. Office.
Colombo, 12th May, 1934.

M. CRAWFORD,
Government Veterinary Surgeon

METEOROLOGICAL REPORT

APRIL, 1934

Station	Temperature				Humidity		Amount of Cloud	Rainfall		
	Mean Maximum	Difference from Average	Mean Minimum	Difference from Average	Day	Night (Corr. Minimum)		Amount	No. of Rainy Days	Difference from Average
	°	°	°	°	%	%		Inches		Inches
Colombo -	86·1	−1·7	75·5	−0·2	77	93	6·3	17·04	17	+ 8·05
Puttalam -	87·0	−2·1	76·1	+0·3	72	89	5·2	1·71	9	− 3·76
Mannar -	89·3	−2·3	78·1	+0·5	76	89	4·8	3·07	9	+ 0·19
Jaffna -	89·4	+0·1	80·7	+1·1	75	82	5·1	0·80	3	− 1·28
Trincomalee -	90·0	+1·4	77·0	−0·4	70	86	4·0	0·92	8	− 1·18
Batticaloa -	88·0	+0·3	75·8	−0·6	74	91	4·7	1·63	5	− 0·29
Hambantota -	87·3	−0·1	76·0	+0·2	72	88	4·3	1·50	7	− 2·00
Galle -	85·0	−1·5	76·7	+0·3	79	88	5·7	10·54	16	+ 0·83
Ratnapura -	89·8	−1·4	73·1	−0·7	80	98	6·4	11·19	21	− 1·18
A'pura -	90·3	−1·1	74·6	−0·2	70	95	6·8	9·83	7	+ 2·96
Kurunegala -	89·3	−2·3	73·9	−0·8	72	95	6·8	4·39	13	− 5·63
Kandy -	86·9	−0·7	69·3	−0·6	66	92	5·0	5·63	12	− 1·18
Badulla -	84·1	+0·3	64·8	−1·5	70	97	4·3	5·72	12	− 1·75
Diyatalawa -	78·2	+0·7	59·5	−0·7	68	89	6·0	7·02	17	+ 0·86
Hakgala -	74·0	+0·4	54·8	+0·2	68	85	5·0	2·62	14	− 4·65
N'Eliya -	71·5	+0·3	49·0	−0·2	68	90	6·2	3·99	11	− 1·68

The rainfall for April was appreciably in excess in the low-country in the south-west of the Island. Slight excess was shown along the northern and eastern flanks of the hills, and in the districts south of Batticaloa, but elsewhere nearly all stations showed deficit, which was most marked on the western slopes of the main hill country.

There were 19 daily falls of 5 inches or more reported, the majority being between the 26th and the 29th. The highest was 8·90 inches, at Labugama, on the 28th-29th.

Until the 16th the usual intermonsoon conditions, weak barometric gradients and local afternoon or evening thunderstorms, prevailed. About the 17th a moderate south-west gradient appeared, with winds that were generally south-westerly at sea level, and for several days the heavier rain was mainly confined to the south-west of the Island, and particularly to the coastal districts. The south-west gradient persisted till the end of the month, but the rain fell off markedly from the 22nd to the 26th, after which there was again heavy rain in the south-western low-country, especially near the coast.

Day temperatures were on the whole below normal, but not markedly so, while night temperatures showed no marked deviations from the average. Humidity and cloud were on the whole above normal in the low-country, and below normal in the hills. The barometric pressure was a little above normal in the south-west of the Island, and more appreciably below normal in the north-east. Wind strength was generally above normal, while the mean direction was on the whole south-west.

Hail was reported on the 9th from Lindula, and on the 16th from Diyatalawa.

H. JAMESON,
Supdt., Observatory.